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CONSUMER CREDIT AND REPAYMENT EXPERIENCE
AN ANALYSIS OF CONSUMER CHARACTERISTICS

by

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A THESIS

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ABSTRACT

This study of consumer credit is an empirical attempt to find some significant relationship between repayment experience and characteristics of credit card users. The purpose is to provide some adequate means by which those who extend credit may be better able to predict the relative creditability of a potential user. Inherent in the study is the assumption that there is a discernible difference between those who exhibit a good credit repayment experience and those who exhibit a poor one.

The data base for the study was compiled from the account records of a retail department store. Two samples were drawn from this source, one sample constituting good repayment experience and the other poor repayment experience.

The techniques used to investigate the relationship were statistical methodologies. Their contribution consisted of examining the interrelationships that exist among the user characteristics and the repayment experience. Once the relationships were established, then the statistical significance of the predictions based on these relationships was tested.

The two methodologies used were two group discrimi-

nant analysis, and step-wise regression. Discriminant analysis produces a dichotomous evaluation. Repayment experience was predicted for the members of the two sample groups, either good or poor, and was then compared to the actual repayment experience to generate an index of correct classification. Step-wise regression produced an equation that predicted a value of the repayment experience. This predicted value was then compared to the actual, and the significance of the disparity tested.

The results of the analysis indicated that there was no statistically significant relationship between repayment experience and credit card user characteristics.

The implications of these results are that the credit card application forms, from which the characteristics are derived, are not a suitable instrument to predict creditability. The other conclusion drawn is that the techniques used are not adequate to fully examine the relationship due to the unquantifiable natureof some credit card application characteristics.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

EXTENT AND INTENT OF THE STUDY

This study is an attempt to analyze certain characteristics of credit card users and determine whether or not there is any relationship between these characteristics and the manner in which the user makes payments on his account. User characteristics are basically quantifiable, distinctive traits, that allow a differentiation to be made between groups of individuals. The manner in which a user repays his account is termed a repayment experience and is related to the number of payments that are missed.

Research in this area is based on attempting to discern cause and effect relationships between the quality of repayment behaviour and the credit card user characteristics. This is a worthy field of endeavour since the rewards that accrue to an accurate determination are directly related to the profitability of the institution concerned.

The actual problem that is associated with the extension of credit is the variability of the repayment experience, coupled with resultant loss in revenue. This problem is widespread in western economies due to the prevalence of credit as an acceptable form of market-place

transaction. Aggregate data on the dollar losses that result from poor repayment experience is not available but figures from the specific firm under observation indicate that over three and one-half per cent of their credit accounts defaulted. This does not include the dollar amounts in arrears.

When assessing how to approach a problem such as this, consideration must be given to the individual differences that exist in any market system. Given these differences, the propensities to interact within the market place are subject to considerable variation. The analysis done in this study is a reconciliation of this consideration, since the techniques used attempt to measure the impact of the differences that exist and relate them to a common situation -- the repayment experience.

The extent of this study is somewhat limited in that only one firm is being examined and only one form of user evaluation that this firm uses is being analyzed. The data for this study was derived from a retail institution which uses consumer credit as one part of their marketing mix. That is, they are not in the consumer financing business, but rather offer credit as a service to their customers. The name of the firm remains anonymous since the information is of a confidential nature. The disclosure of such information might put the firm in a compromising position with respect to the existing card users. This in turn might have an effect on any

competitive advantage the firm enjoys in the market place.

The data used was gathered from a random sample taken of five hundred and fifteen card applications in the month of January, 1971. A description of the data and the methods used to derive it are discussed in Chapter II.

Characteristics of the Type of Credit Under Examination

The type of credit transaction under examination is defined as installment credit. That is, a consumer wishes to purchase some commodity without effecting the full purchase price at the time title is transferred. To facilitate this type of desire it has become common practise in the resident marketing system for the seller of this good to provide some formal procedure acceptable to both parties. This procedure takes the form of partial payments over a specified time period.

Policies differ between organizations as to the degree of selectivity that will be imposed on the evaluation of a potential user. This is mainly a function of the aims of the firm concerning credit usage. Some organizations provide credit solely on the basis of a service, discounting to a large degree, the costs associated with it. On the other hand, the particular firm under investigation relates wholly to the idea that, "The primary function of the Customer Accounts Department (the credit department) is to increase profitable sales." This quotation is contained in the literature of the

organization for the purpose of verbalizing the aims and objectives of the credit department.

To effect a profitable credit situation then, some form of selectivity is necessary to eliminate those whose potential to have a "good" credit repayment experience is inhibited.

Selective Risk Taking

Most credit transactions involve some form of risk. Those who grant credit accede to the possibility of default and attempt to compensate for this by being selective in the type of people and organizations to which they grant credit. In the firm used in this study, a regular evaluating procedure is followed:

1. The taking down of information concerning the present status of the individual with respect to occupation, age, marital status, length of residence, income, length of employment, the existence of both current liabilities and other income as well as some personal references that may attest to the creditability of the person.

2. Some form of further investigation, usually through the use of a central credit bureau.

3. An evaluation based on the particular experience of the credit grantor with respect to the preceding two factors.

This third step is the one that is of major interest in the study, since the experience of the grantor

is subject to many personal biases that may not be relevant to the purpose at hand. The term "experience" also denotes some subjectivity which may lead to inconsistencies in the evaluation. On the basis of this consideration a more rational approach would be the use of some quantitative technique that accounts for the first two factors, but eliminates the subjective evaluation and substitutes an objective methodology.

Research Objectives

The research objectives may be stated by the following hypotheses:

(1) Good and poor credit risk populations are distinct populations.

(2) The difference between the good and poor credit risk populations is quantifiable and predictable.

A review of the literature was undertaken to provide some background information on the type of analysis done in this area. While the search was not exhaustive, it was intensive. The results proved to be of limited value since the main area of concentration with respect to the relationship between repayment experience and consumer characteristics was in the field of specific financial institutions. These studies related the characteristics of the consumer to risk, but in a manner that was not applicable to the type of study done here. The character-

istics of the user were considered secondary to the type of credit transaction that was taking place. The credit transactions in these studies were mainly the small loan type and the analysis was concentrated on examining the effects of altering the loan size, the terms of the contract, and time interval specified for the repayment, rather than examining the effect of individual differences of the users. An attempt was made, however, to extrapolate from these studies, especially Durand (Durand, 1941) and Moore and Klein (Moore and Klein, 1967).

Research Plan

The design of the investigation followed a specified format. Step one involved deciding how to separate poor and good repayment experience. To use a quantifiable distinction it was necessary to make an assumption that the present number of payments past due on an account would be representative of the long term condition of the account. Using this assumption it was possible to discern two populations: population one -- the good repayment experience group, and population two -- the poor repayment experience group.

Sample sizes were then calculated for each population and the representative number of units were drawn from each. The sampling units were the actual application forms of the existing users. This activity is described

in Chapter II.

From these forms the desired data concerning the status of the individuals was extracted and punched on computer data cards.

Once the data was in card form, the actual analysis, using two computer programmes is followed. A description of the techniques is contained in Chapter II, with reference made to the computer programmes used.

The results of the two types of analysis, stepwise regression and two group discriminant analysis, are presented in table form with pertinent evaluation in Chapters III and IV.

Conclusions were drawn with respect to the analysis of the results and implications drawn for further investigation. The conclusions dwell mainly upon the inadequacy of the techniques employed based on the unquantifiable nature of some characteristics. The value of credit analysis is, however, upheld and comments to this effect are contained in Chapter V along with the conclusions.

CHAPTER II

RESEARCH DESIGN

The research design followed in this study is of a descriptive nature. The objectives of descriptive research are to "concentrate on those aspects of the situation which can be expected to reveal, as precisely as possible, the nature and relative size of the opportunities for...action involved in the situation, and the constraints on that action imposed both by the situation itself and by the resources available to management." (Wasson, 1964, p. 130). The expectations of this study are twofold. First, the results of the analysis will be useful to the credit department management. Second, the techniques used by the study will be applicable in the management function of evaluating potential credit card users of the firm.

Those aspects of the situation which are expected to reveal the true identity of the problem are the characteristics of the users. The situation itself is the incidence of poor repayment experience.

The constraints of the situation are evolved from the realization of the fact that the resources of the firm are not adequate to fully investigate the potential of a prospective user. This leads to a further realization

that some effective means must be developed to predict the repayment experience based on the available information.

In the context of this study the available information is restricted to those characteristics of the user contained on an application form. A sample of the form is contained in Appendix I.

Quality of Credit

Criteria for a good or poor credit risk are difficult to quantitatively measure. This is mainly because degrees of deficiency in the repayment of the credit balance are tolerated given different situations concerning the user. That is, a person who is one month behind in his payments is not necessarily a poor credit risk. There may be many extenuating circumstances that produced this condition that are not central in an examination of the quality of the account.

For the purpose of this study a specific condition was established as the criterion for a good or poor account. The quality of the account was linked directly to the payment condition of the account. A poor credit risk was assumed to exist when the account balance was delinquent from the standpoint of payments by at least one month. That is, at the time the sample was taken, the account was in arrears for a period of time greater than or equal to one month and less than or equal to nine months. The nine month cut-off point is arrived at

since the internal operation of the firm dictated that some formal action exterior to the firm itself would be applied after this point was reached. This would cause the applications to be removed physically from the sampling area and as such would not be accounted for in the study. The number of these removed accounts was extremely limited and would account for a negligible percentage of the population.

As a consequence, therefore, a good credit risk would be defined as an account where the present balance is zero, paid up to date, or deferred, due to some prior arrangement with the credit department. The deferred rating has nothing to do with potential default of the account, but rather with the fact that merchandise may not have been received by the customer as yet, and as a consequence he will not have made any payments on the outstanding balance.

As was mentioned, the actual design of the research to be undertaken involved the use of a formal and informal analysis of the data. The formal methodologies used are discussed below and are limited to the use of two quantitative techniques that analyze the interrelationship between variables in an attempt to predict a single nominated variable.

Factors Used in Analysis

The credit card application form contains a

multitude of variables, most of which would provide some clue to the relative ability of the potential user to be a good or poor risk. There is an inherent difficulty, however, in attempting to apply some form of quantitative analysis to this data. Those characteristics that are of a non-scaler nature (that is, there is no sequential ranking of the characteristic) are not easily reduced from qualitative to quantitative form. For this reason they were exempted from the analysis in the initial stages. These characteristics include:

1. Sex.
2. Marital status.
3. Type of residence arrangement.
4. Occupational Group.
5. The existence of a bank account.
6. Other income.
7. Other current liabilities.

These qualitative variables are not excluded, however, but are subjected to another form of analysis which attempts to isolate observed differences between groups.

These characteristics which are included in the main body of the analysis include:

1. Family size.
2. Age.
3. Length of residence.
4. Length of employment.
5. Monthly income.

These five variables are clasically adhered to as the stability and capacity of an individual to fulfill his obligation under a credit agreement. The argument is that an older person who has been at his present address and job longer will be more stable. And naturally, the more money he makes at his job, the better able he is to repay his debt obligation. The acceptance of these arguments is obviously widespread since they, the variables, show up only in slightly different form in many credit-extending situations.

Methodology

Sample Size Consideration

In the analysis to be performed, two populations will be defined from one universe.

Population 1. Good credit risks -- these are the bulk of the accounts resident in the credit department. The only criterion employed is that there are no outstanding payments on the account when the sample is drawn.

Population 2. Poor credit risks -- these accounts are in the minority, the criterion being some form of delinquent behaviour with respect to repayment.

This is not the best type of criterion that can be made for establishing the two populations, since it is a point in time comparison. Obviously the best type of distinction would be the examination of the complete

history for the account, incorporating all deviations from the time the account was opened. This consideration is examined in the following chapter. The sample sizes themselves will be calculated using a standard formula. One sample will be taken from each population.

Sample Drawing Technique

Once the sample sizes are calculated, it will be necessary to devise some form of selection technique for the drawing of sample units.

Population 1.

The account application forms for the good risk accounts are arranged on what are called rotary diebolds. In this instance there were two of them. The accounts were arranged on these rotaries by account number. Each rotary has three levels, and each level contains two hundred sections. Within each section will be a grouping of accounts filed numerically by account number.

To draw randomly from this arrangement a random number table will be used. Four factors are contained in this selection process. Firstly, a random number will be used to determine which rotary is to be used; if the number is even (zero is considered to be even), that is divisible by two, then the first rotary will be used; if the number is odd, then the second rotary will be used. Secondly, the level on the rotary has to be considered; if the number to be used is one, four, or

seven, level one is used; if the number is two, five, or eight then the second level is used; if the number is three, six, or nine, then level three is used. If the number is zero, it will be disregarded and a new number used. Thirdly, the grouping within the level will have to be chosen; if the number is even then the groupings from one to 100 will be considered; if the number is odd then the grouping from 101 to 200 is used. Fourthly, the unit within the grouping will be drawn, using a random number.

For example, the random number 8 - 3 - 79 - 24:

Number	Inspection	Go to
Step 1 8	Divisible by 2	Rotary 1
Step 2 3	Belongs to 3, 6, 9	Level 3
Step 3 79	Seven is odd	Section 179
Step 4 24	Know total in grouping	24th application form

Population 2.

The drawing of these applications will be much easier since the arrangement of the forms is by collection correspondent. Each girl has a desk and file of delinquent accounts. It will, therefore, only be necessary to randomly select a desk and a position within a

single grouping. These groupings are contained in a file called the "bad box."

Each desk will be assigned a number in numerical sequence such that in drawing a random number a desk is chosen.

The sampling will continue for each population until the desired number of units, as calculated in the following section, is fulfilled.

Sample Size Calculation

The sample size necessary for both the good risk and the bad risk populations is determined by three parameters: (1) the proportion of good accounts in the total population, (2) the range of error acceptable from using the determined sample size, and (3) the confidence limits associated with the representatives of sample.

The total population of all accounts was approximately 60,000. The total number of accounts that were in some form of default was calculated by the department to be somewhere between fifteen and twenty per cent. This figure was arrived at by an examination of the dollars outstanding on accounts and noting the total of the delinquent dollars. The actual number of accounts, calculated by taking a census of the application forms segregated by the department as being delinquent, proved to be sizably different and numbered approximately 1,000. This large discrepancy could not be wholly

accounted for by the department other than by the explanation that the outstanding balances, in dollar terms, of the delinquent accounts, was of such a magnitude that it constituted a figure of 17 per cent. The assumption was made, therefore, that the census of the delinquent accounts provided an accurate picture of the number of accounts that would constitute Population 2 -- the poor credit risk group.

A standard formula for the calculation of sample size was used (Freund and William).

$$n = p(1-p)\left\{\frac{1.96}{E}\right\}^2, \qquad (2.1)$$

where: n is the sample size to be calculated,

p is the estimated proportion of good credit risk in the population,

E is the tolerated range of error

Using 2.1;

$$n = .8(.2)\frac{(1.96)^2}{(.045)^2}$$

$$n = 299.$$

The sample size of 299 constitutes desired level of confidence equal to 95% and a tolerable range of error equal to 4.5%. Two hundred and ninety-nine, therefore, was used as the sample size for the good credit risk accounts that were to be drawn.

The actual values chosen for p and E are incumbent

upon the analyst. In this case a tolerable range of error (E) determined by management of the firm in question, was five per cent. To provide for contingencies the analyst chose a level of four and one-half per cent. This lesser range of error decreases the riskiness of the sampling by increasing the sample size.

The value of p, the estimated proportion of good accounts in the population, was assumed to be 80 per cent. Again, this figure allows for some risk factor since the actual was estimated above this figure. The use of a smaller proportion in each case raises the sample size.

The sample size for the poor credit risk population was derived by applying the same formula with the addition of the finite correction factor. This correction factor allows the same precision to be applied to a smaller sample size, when it is drawn from a significantly smaller population.

The sample size for the poor credit risk group equals 216. Using this figure it is possible to test that the same range of error is used, assuming a population size of 1,000.

$$\left(\frac{\quad E}{1.96}\right) = \frac{(.2)(1-.2)}{216} \cdot \frac{1{,}000 - 216}{1{,}000 \quad 1} \qquad (2.2)$$

Solving for E:

$$E = 4.5\%.$$

This is consistent with the range of error that is tolerated with a sample size of 299 in the first group.

Methodology of Analysis

Step-wise Regression Analysis

This technique takes a dependent variable (in this case the months due on the account payments) and one or more independent variables (the user characteristics) and on the basis of the degree of linear association between the variables, attempts to predict the dependent variable with the independent variables. With respect to the study, the resultant function produced by the regression will be used to predict the actual value of the account balance. In this manner the degree of delinquency will be explicitly stated in terms of the number of payments that are past due.

The methodology of step-wise regression is a stop-and-search type of operation. Before an actual regression equation is produced, the computer programme chosen to perform this task provides a series of tables which present the analyst with information that will be used in the regression. The CS101 Stepwise Multiple Regression Program (Grobben, 1970) produces the following tables:

1. Listing of data, actual values to be used.
2. Mean, variance and standard deviation for each variable to be used in the regression.
3. Simple correlation matrix.

Once this stage is reached the calculation of a regression equation will begin by using only one variable, the one with the highest simple correlation coefficient with the dependent variable. The criterion for entry of variables into regression is its relative ability to explain the amount of variance between itself and the dependent variable. The actual entering of variables can be constrained by the analyst simply by inserting criteria measures. The type used by this programme is called a requantial F. test. What this indicates is that before a variable can be entered it must pass a test of significance based on the F. statistics. The variable with the highest F. value will automatically be chosen as the next variable to enter. This process continues until all variables are entered, subject to the constraints set by the analyst. That is, variables may be deleted or not included if they are not significant on the F. test.

Once the first variable is entered, the programme calculates an equation which has the facility to predict the dependent variable based on a constant term and a coefficient for the variables entered. Often this first variable is entered and the terms calculated, the programme then goes ahead and selects another variable to enter subject to the abovementioned constraints.

When the regression is terminated, that is, all the variables that are desired are entered, then the programme produces a summary table displaying the fol-

lowing complete listing of values:

1. The observed values of the dependent variables.
2. The predicted values of the dependent variables.
3. The residuals, the observed difference between the actual and predicted values of the dependent variable.
4. The confidence limits for the predicted individual observed values of the dependent variable.

The actual mathematical workings of step-wise regression will not be described here since they are complicated and require an abundant knowledge of statistics. The general form of the regression equation is:

$$Y = Bo + B_1X_1 + B_2X_2 + \ldots + BnXn + e$$

Where:

Y is the predicted dependent variable (number of payments due).

Bo is a constant, indicating the Y intercept.

B_1, B_2 ... Bn are the regression coefficients.

X_1, X_2 ... Xn are the independent variables (the user characteristics).

e is a randomly distributed error.

To obtain these factors it is necessary to calculate the simple correlation coefficients between the variables, the multiple correlation coefficients and the partial correlation coefficients. Using Tull and Green as a source, the following description of the coefficients is provided (Tull and Green, 1966, p. 321):

Simple Correlation Coefficient -- a measure of the degree of linear association between two variables.

For example monthly income and the number of payments past due on a credit card account.

Partial Correlation Coefficient -- a measure of the degree of linear association between the dependent and one of the independent variables in a multivariate analysis when the effects of the other variables in the analysis are held constant. For example, if the number of payments past due is the dependent variable and income and family size are independent variables, a partial correlation coefficient could be determined for the linear association between number of payments past due and income with the effects of family size being held constant.

Multiple Correlation Coefficient -- a measure of the linear association between the dependent variable and two or more independent variables. For example, a multiple correlation coefficient could be determined for the number of payments past due as the dependent variable and income, family size, age as the independent variables.

The process of step-wise regression allows the analyzer to look at what is happening at every level of the regression and to test the significance derived from including each additional variable in the analysis. This is a valuable aid since it provides an examination of several statistics that are being produced at every stage.

The first value that will be looked at to examine the precision of the regression is R^2. R^2 is the square

of the multiple correlation coefficient and may also be referred to as the "coefficient of multiple determination." (Draper and Smith, 1968, p. 62). The larger the value of R^2 approaching unity the better the fitted equation explains the variation in the data.

There is a problem in using R^2 as a measure of the usefulness of the equation. This problem is centered in that R^2 can be forced to unity by the fact that we have reached a saturation point with respect to the number of observations versus the number of parameters.

Another statistic that is produced at each step of the regression is the value of s, which is the standard error of the estimate. The desired result of any additional variables that are entered in to the regression is that they will reduce the standard error of the estimate, therefore, the smaller the value of s the more useful is the regression equation. The problem with this measure of the goodness of the regression equation is that it also may be "manipulated" in that by including enough parameters the value of s can be driven down to zero.

Given these restrictions the technique is still a valuable type of analysis to perform since it not only estimates what characteristics are important but also to what degree they are important in predicting the condition of an account. The regression equation that is used will take the individual users characteristics and based on the experience that was used in the derivation

of the equation, predict what the condition of the account will be at a given point of time.

It is necessary to note that the relationship that exists between the dependent variable (months due on the accounts) and the independent variables (the users' characteristics) -- this relationship is not necessarily one of cause and effect. The analysis of the variables gives only a relationship based on observable cases, such that to imply causation on the part of the independent variables is a discretionary move and involves risk. The evaluator of the results may draw an implication from the analysis but he may not infer causation.

Two Group Discriminant Analysis

Two group discriminant analysis is a method whereby it is possible to discriminate between two populations on the basis of their characteristics. In the case of this study the two groups will be the good and the bad credit risks, and the characteristics are the reported information on the application forms. In this analysis the characteristics of the groups will be produced in the form of a discriminant function. The group that the individual is in will be determined by the score that he receives based on the function. The actual programme used to generate this function was the BMD04M Two Group Discriminant Analysis Computer Program (Dixon, 1965, pp. 185-203).

Assumptions of the Technique:

(1) The observations are grouped, each observation in each group involves at least two variables.

(2) The populations from which the samples are obtained, are multivariate normal with different mean vectors, and all populations have identical covariance matrices.

(3) Each population distribution is determined by the same variables.

(4) The variables are independently distributed.

(5) The populations are exclusive and exhaustive.

Theory for Discrimination Between Two Groups:

According to the assumptions, group differences consist of differences in the group means of the two populations. Multiple discriminant analysis uses one variable, the discriminant score which reflects the influence of all the variables in each group simultaneously in such a way that the groups are separated in a manner which maximizes the probability of correct classification. This is achieved by a linear discriminant function which expresses the discriminant score as a linear combination of all variables analyzed.

$$Z = a_1x_1 + a_2x_2 + \ldots \qquad \ldots + a_px_p$$

Z = discriminant score, obtained for each observation.

a = vector of coefficients, which are unknown and have to be determined.

x_i = variables, i = 1....p, X is a p by 1 vector of variables.

The coefficient vector has to be determined in such a way that the variance between populations relative to the variance within populations is maximized (Burger, 1970, pp. 75-84).

There are two statistics produced:

An F statistic considering the appropriate degrees of freedom, in order to find that linear combination of variables that discriminates best between groups.

A D^2 statistic, which is an expression for the generalized distance between groups. For a full discussion of D^2 see Rao (Rao, 1963).

If the actual F value is greater than the table F for a certain significance level (say five per cent) there exists a difference between the group means, as we are implicitly rejecting a null-hypothesis of equality of group means.

Using for example, the sample of credit card applications these will be classified into two groups, either good or poor, based upon the criterion of payment history at a point in time. Each application will be characterized by his scores for the five application criteria measures. Given an application with its five scores, the statistical problem will be to determine from which group he came, and hence to which group a potential user would belong. Based upon the scores, if discriminant

analysis indicates the application has a consistently higher probability of statistically belonging to the group in which they are classified by account history, support is given to the proposition that the criterion of a good or poor risk is related to the five application variables.

The criteria for the correctness of classification follows Massy (Massy, 1965, p. 40). Given a two group situation as depicted in Figure 1 -- using two variables:

DISCRIMINATION OF TWO HYPOTHETICAL POPULATIONS ON TWO VARIABLES

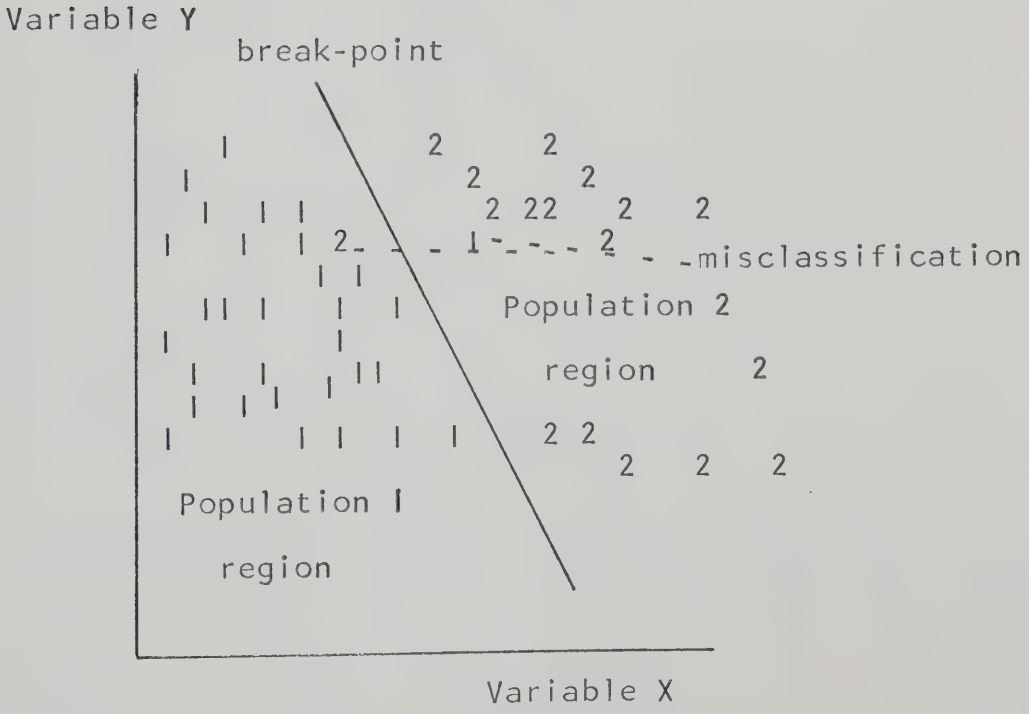

Figure 1

Depicted graphically, the probability that an observation will fall in Population

PROBABILITY THAT AN OBSERVATION
WILL FALL IN POPULATION 1 OR 2

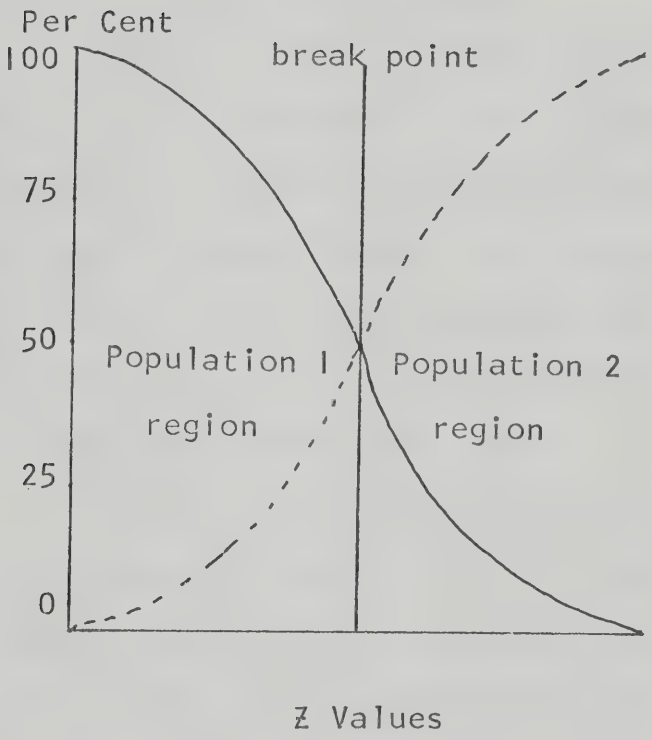

Figure 2

The critical value for Z, or the break point is, as far as misclassification is concerned, "half-way between the means of Z for A and B, so that at this point an observation has about an equal probability of falling into A or B" (Massy, 1965, p. 40).

The advantage of this type of analysis is that it produces an easily understood result, a dichotomous

situation where a potential credit user is declared either a good risk or a poor risk depending on the value of his discriminant score. This type of format facilitates its use in commercial concerns where the interpretation of results of a particular type of analysis is sometimes secondary to the result itself.

The one thing that has to be taken into account when using this technique is the situation where the results may be of statistical significance, but produce a poor discrimination between the two groups. If this situation does arise then the procedure has invalidated itself within the context of the variables that have been used to produce the discriminant scores.

The basis for using these two techniques of analysis is the prediction possibilities of their evaluations. In one case, the regression analysis, the prediction is of an actual value, the number of monthly payments past due on the account, while discrimination involves the prediction of group membership.

Chapters III and IV, following, present the results and analysis of the study, using the methodologies described in this chapter.

CHAPTER III

RESULTS AND ANALYSIS OF REGRESSION

The format for an examination of the regression analysis follows a two stage approach. Stage one is the regression of the two groups, good and poor credit risks, run simultaneously. Stage two deals with the poor group independently. The attempt of the regression analysis is to predict a dependent variable, from a set of independent variables, in this case, the condition of an account balance, from the credit card users' characteristics.

When the two regressions are run separately there is an anticipated result. This result would be that the coefficients of the two regressions generated would bear some similarity. This similarity would take the form of indicating that the same variables would be significant in both types of regression, both indicating that the increase in the value of the dependent variable would be accompanied by an increase or decrease in the value of the independent variables. While the actual coefficients of the regression equations would be different, the relative significance should remain the same.

In the following sections the two regression equations will be treated separately in table form. The tables will indicate the values of R^2, the square of the

multiple correlation coefficient, s, the standard error of the estimate, and the actual regression equation coefficients. Also presented will be the values of the correlation coefficients, which indicate the interrelationships existing between the independent variables and the dependent variable.

Prior to the running of the five quantified independent variables, (family size, age, length of residence, length of employment, and monthly income), an attempt was made to run a total regression using all twelve independent variables. This attempt made use of a technique for inserting dummy variables into the regression analysis. Dummy variables are simply numerical coefficients used to represent the qualitative nature of a factor, quantitatively. This technique is based on a binary format for the variables, that is, each possibility of occurence for each independent variable is paired. This produces a large number of transformed variables in the place of the original twelve. The possible number of sub-groupings for each qualitative variable is presented in Table I. To calculate the number of transformed variables requires the simple multiplication of the sub-groups together. The total number of binary combinations possible for these factors is 1,188. In other words, the number of variables that would have to be accounted for in an analysis would be 1,188. If the remaining five variables were then entered into the same analysis as they would have to be,

then the possible number of combinations becomes astronomical, well beyond the comprehension level, as well as the computational.

TABLE I*

Number of Sub-groups Within
Each Characteristic

Characteristic	Sub-groups
Sex	2
Marital Status	3
Residence Arrangement	3
Occupational Group	11
Bank Account	2
Other Income	2
Other Liabilities	2

*A breakdown of each sub-group and an explanation of dummy variables is contained in Appendix II.

In an attempt to overcome this situation a subjective rating was applied to each sub-group characteristic. The analysis was then run with these ratings in. A sample printout of this run is included in Appendix III. This action, however, presupposes some knowledge of the relative creditability of the characteristics which is really the intent of the study. For this reason the attempt to include these variables in the main body of the analysis was deferred to a later stage and the regression

analysis dropped.

Early (Early, 1966) has grappled with this problem of using "structural credit data" for the purpose of examining relationships between characteristics and quality of repayment experience. He notes that two basic problems appear. First, one problem already discussed, was that of the non-scaler nature of characteristics such as occupation. Second, "relevant variables are sometimes both numerous and heterogeneous" (Early, 1966, p. 205). That is, it is difficult to be all-inclusive and deal with factors of a dissimilar nature all at the same time. The effects of this problem are limited in this study by the fact that the variables that are deemed relevant appear on the application form, since this is the only instrument that we have to deal with that appears consistently. The use of credit bureau data was also considered but rejected, since not all the accounts in the sample had been subjected to this form of scrutinization at the time of application.

The analysis was then resumed using only the five remaining independent variables.

Regression Examining All Groups

The correlation matrix indicated in Table II, provides an early insight into the value of the regression type of analysis for this study. The most significant values to be noted are those coefficients which relate

TABLE II

CORRELATION MATRIX -

ALL CREDIT ACCOUNTS

Variable	Payments Due	Family Size	Age	Residence	Employed	Earnings
Payments Due	1.000	.021	-.012	-.045	-.109	.024
Family Size		1.000	.270	-.011	.173	.246
Age (Yrs)			1.000	.281	.460	.166
Residence (Yrs)				1.000	.433	.014
Employed (Yrs)					1.000	.179
Earnings ($)						1.000

to the correlation between the dependent variable, number one and the independent variables, numbers two through six. In each case the values are very small, indicating little or no correlation between the dependent variable, the number of payments past due and the independent variables, the users' characteristics.

Taken individually the values represent the following relationships: as the number of payments due increase, so does the family size, and the monthly earnings; as the number of payments decreases, so does the age, years resident, and years employed. Generally then, the good risk accounts would tend to be associated with those characteristics that are of a stability nature, length of residence and employment, and with relatively increasing age. The contrary effect of family size is not unexpected since the capacity to repay may be somewhat impaired by the magnitude of the dependents. The earnings effect is somewhat surprising since capacity to repay is frequently directly related to the dollar amount of earnings. An explanation for this is related to the actual magnitude of the coefficients themselves. What is really being demonstrated by these coefficients is that there is no significant correlation between the number of payments past due and the credit card users' characteristics.

TABLE III

REGRESSION ANALYSIS OF CREDIT ACCOUNTS

Step	Variable Entered	Number	Order of Variables in Regression	R^2	s
1	Years Employed	5	5	.0119	2.135
2	Earnings per Month	6	5, 6	.0139	2.135
3	Age	3	5, 6, 3	.0154	2.136
4	Family Size	2	5, 6, 3, 2	.0171	2.137
5	Years Resident	4	5, 6, 3, 4	.0171	2.139

TERMINAL REGRESSION EQUATION

$$Y = 1.086 + .033X_2 + .077X_3 + .001X_4 - .049X_5$$

This lack of significance is carried over into the actual regression equation. Table III presents the values for R^2 and s. R^2, which indicates the amount of variation being explained by the independent variables, is extremely low at both the initial and terminal stage of the step-wise regression. The first variable being entered, years employed, explains only 1.2 per cent of the total variation while at the final step, with all the variables in the regression, only 1.7 per cent is being explained.

The value of s, the standard error of the estimated value of the number of payments past due, is extremely high. This indicates that the precision with which the equation is making predictions is very poor. At the initial stage of the regression, the standard error was 2.135, while at the terminal step the value was 2.139. The actual prediction of the number of payments past due was worse at the final step than it was at the first.

This standard error is an average indicator of how incorrect the predicted value of the dependent variable was compared to the actual value. When relating this back to the actual case of taking a potential credit card user's characteristics and applying the regression equation generated, the value of s indicates that the predicted state of the account balance would vary by this amount, on the average.

R^2 and s both represent measures of the accuracy of the equation generated by using the existing account

information. In this case the value of the regression type of analysis is severely limited by the magnitude of both statistics. The only conclusion to be drawn from this examination of the results is that the regression analysis is wholly inadequate for the purpose of delineating an adequate predictor of the condition of account balances from the credit card users' characteristics.

Regression Examining Poor Risk Group

An examination of the poor group alone produced almost identical results as that with both groups included. The correlations in Table IV are not identical with those in Table II, but the relative insignificance of the values is. In assessing the position of an account, the interpretation of the relative value of these figures is severely limited. The same conclusion holds true for the values of R^2 and s in Table V. In Table V, a very small value for R^2 and a large value of s is consistent with the findings in the previous regression.

TABLE IV

SIMPLE CORRELATION MATRIX - POOR CREDIT ACCOUNTS

USING SIX VARIABLES

Variable	Payments Due	Family Size	Age	Resi-dence	Employed	Earnings
Payments Due	1.000	.037	.089	.063	-.033	-.071
Family Size		1.000	.209	.008	.161	.206
Age (Yrs)			1.000	.270	.349	.101
Residence (Yrs)				1.000	.465	-.027
Employed (Yrs)					1.000	-.087
Earnings ($)						1.000

TABLE V

REGRESSION ANALYSIS OF POOR CREDIT RISK ACCOUNTS

Step	Variable Entered	Number	Order of Variable in Regression	R^2	s
1	Age	3	3	.0079	2.121
2	Earnings	6	3, 6	.0144	2.119
3	Years Employed	5	3, 6, 5	.0185	2.120
4	Years Resident	4	3, 6, 5, 4	.0231	2.120
5	Family Size	2	3, 6, 5, 4, 2	.0253	2.122

Terminated Regression Equation: $Y = 2.959 + .061X_2 + .021X_3 + .027X_4 - .040X_5 - .001X_6$

The fact that the relative positions of the independent variables switched when the second regression was attempted has no bearing. The impact that might have been generated had this occurred with greater precision in the regression equation is lost due to the total insufficiency of the technique to provide a viable prediction model.

An overall evaluation of the step-wise regression analysis is presented along with comments on the discrimiant model in Chapter V.

CHAPTER IV

RESULTS AND ANALYSIS OF DISCRIMINANT AND CHI-SQUARE EVALUATION

Two Group Discriminant Analysis

Once the regression analysis technique failed to provide significant results, it was necessary to adopt a different approach to the problem. Regression analysis dealt with attempting to predict a specific disposition of an account balance, indicating the number of payments that were past due. Consideration was then given to providing a more generalized prediction. Instead of attempting to find exact values of the payments due, attempt to predict the risk group that a potential user would fall into, given the set of characteristics found on the application form. This is the rationale behind two group discriminant analysis. The model predicts memberships from a given set of independent variables. Relative ranking within this group is based on the magnitude of the independent variables that are used in the calculation of the discriminant score. The dependent variable is of no significance in the actual calculation and represents only the pre-analysis parameter for actual group membership.

Actual group membership was decided on the basis

of the previously used criterion, good risk group -- no payments due, poor risk group -- payments due.

For discriminant analysis to work, there must be a quantifiable difference in the values of the independent variables' means, for the two groups. Table VI indicates that this premise is not violated, since the mean values of each variable in the two groups is different. The actual difference in the mean values is quite small indicating a relative lack of heterogenecy between the two groups. This fact is significant since discrimination works on the basis of the magnitude of the difference between the two groups, if the difference is small then the discriminating ability of the model will be impaired.

TABLE VI

DISCRIMINANT ANALYSIS

VARIABLE MEANS BY GROUP AND

DIFFERENCE IN MEANS

Variable	Good Risk Mean	Poor Risk Mean	Difference
Family Size	3.21070	3.24074	- 0.03004
Age	33.88962	32.54166	1.34796
Length of Residence	4.16217	2.92775	1.23442
Length of Employment	5.24680	3.64858	1.54821
Earnings per Month	454.55518	481.64331	-27.08813

An examination of the discrimination matrix, (Table VII), relates the ability of the analysis to discriminate between two groups on the basis of their independent variables. The good credit risk group was predicted correctly 55% of the time, while the poor credit risk group was predicted correctly 71% of the time. The equation used to produce the discriminant score is presented in Figure 3.

DISCRIMINANT ANALYSIS

FUNCTION COEFFICIENTS

$$Z = - .00002X_2 + 0.0X_2 + .00002X_3 + .00008X_4 + 0.0X_5$$

Where:

X_1 is Family Size

X_2 is Age

X_3 is Length of Residence

X_4 is Length of Employment

X_5 is Earnings per Month

Good Risk

Sample Size 299

Z Mean Value - .000025, Standard Deviation .000064

Poor Risk

Sample Size 216

Z Mean Value - .000046, Standard Deviation .000064

Figure 3

TABLE VII

DISCRIMINANT ANALYSIS MATRIX

USING FIVE VARIABLES

Group	Classification	Number Most Similar To Good Credit Risk	Number Most Similar To Poor Credit Risk	Total Classified In Each Classification	Percentage Correctly Classified
1	Good Credit Risk Classification	166	133	299	55.5
2	Poor Credit Risk Classification	62	154	215	71.3
	Total Number in Each Classification by Discriminant Analysis	228	287	515	

Chi-Square Value = 0.10765 (D^2) Not Significant at any Level of Confidence

F Test Value 2.67898

Group 1 Mean Ƶ Value - .000025

Group 2 Mean Ƶ Value - .000046

The coefficient values of the discriminant equation are important in that they indicate the relative value of the variables in the producing of the discriminant scores. In two cases, age and earnings per month, the variables were considered to be of no significance. This result is somewhat surprising since the regression analysis indicated that age, for instance, was not important. Length of employment is considered as the most important of the variables in discerning good credit risk possibilities, family size is considered as the major factor in inducing poor credit risk group membership.

There is a major flaw in this discriminant model which tends to negate the viability of the results. While the model was able to discriminate successfully 72% of the poor credit risks, the overall statistical significance test of the prediction was not significant. This test involves the use of D^2, tested using chi-square table of values. What this lack of significance indicates is that the results produced may be wholly attributable to chance, rather than the relationship between the mean values of the variables.

The predictive ability of this technique must therefore be discounted as was that of the regression analysis. In both cases the credit card users' characteristics have proven themselves to be inadequate to produce a model with practical applications to the problem that is being faced.

Chi-Square Contingency Table Analysis

Chi-square contingency table analysis is a technique whereby two or more attributes or characteristics are used to classify data. The purpose of this type of analysis is to test the significance of the observed relationships between the characteristics in such a way as to determine whether the relationships are significant or due to chance. The significance testing takes the form of comparing a computed value of chi-square with a table of chi-square values at an appropriate number of degrees of freedom. The calculated value of chi-square is derived by computing an estimated value in a classification matrix and comparing it arithmetically with the actual value. The actual calculation involves dividing the observed difference between the actual and predicted matrix cell value by the predicted value, this dividend is then squared and the squares summed. This value is the computed value of chi-square, and compared with a table value of chi-square.

The existence of a larger computed value than the table value indicates that the observed difference is significant and is not entirely due to chance, at a given level of confidence.

This type of testing was applied to the seven unquantified variable characteristics on the application form: sex, marital status, type of residence, occupation,

and the existence of: a bank account, other income and other current liabilities. The results of this analysis is presented in Table VIII. The complete chi-square calculations are included in Appendix IV.

TABLE VIII

SUMMARY OF CHI-SQUARE ANALYSIS

Variable Characteristic	Chi-Square Value	d.f*	Significant at
Sex	2.54	1	0.100
Marital Status	5.24	2	0.010
Type of Residence	30.88	2	0.005
Occupation	30.59	10	0.005
Bank Account	3.24	1	0.100
Other Income	2.44	1	0.200
Other Liabilities	0.09	1	0.800

*Degrees of Freedom

The value of chi-square analysis becomes readily apparent when the significance levels are examined. Two characteristics, type of residence arrangement and occupation are significant at the .005 level. This is the same as saying that 99.5% of the time, the observed difference between what would be predicted and what actually occurred, was due to the variation in the data and not chance.

To state it again a different way, there is a significant difference between good and poor credit risk groups based on what was observed, as opposed to what would be anticipated, if the two groups were homogeneous in nature. This same conclusion holds true for the remaining characteristics with lesser degrees of assurance, based on the confidence limits imposed. These findings lend credulence to the use of the application form as a device for discriminating between poor and good credit risk.

The only problem associated with type of analysis is that it gives no indication of how to predict the relative creditability of the potential credit card user. The technique establishes only the fact that based on the characteristics, there is an observed, statistically significant difference. To extrapolate beyond this point would be hazardous in the extreme.

The analysis does indicate what characteristics are relatively more important than others, occupation for instance, but to what degree is still in doubt. These drawbacks, while of some consequence, do not negate the value of chi-square contingency table analysis as a valid approach to examining the unquantifiable characteristics.

CHAPTER V

CONCLUSIONS AND IMPLICATIONS

The Analysis Done

In drawing conclusions with respect to the relative merits of the analysis done, it is necessary not to lose sight of the intent of the study. At the outset a restrictive limitation was put on the amount and source of information that was to be included for analysis. This limit was that all data was to be collected from the retail credit card application form of existing credit card users. This limited extent must be taken into account when assessing the evaluation of the analysis and related conclusions.

With reference to the two main techniques applied, step-wise regression analysis, and two group discriminant analysis, the conclusions are obvious. Neither technique proffered a suitable means for predicting the potential creditability of a new credit card applicant from the data indicated on the form. Both techniques did provide some evidence of the relative susceptibility to good or poor credit risk, but the laxity of the confidence limits that had to be imposed to make the results statistically significant were highly restrictive and would prove inoperable

in implementation.

The unacceptability of the techniques is not the same as saying the techniques are not adequate. The techniques themselves may be adequate but the quality of the data being analyzed may be suspect. This problem can be looked at from the standpoint that the five quantifiable variables that were used in the analysis are simply not the ones that are indicative of the quality of repayment experience being expressed, and that the remaining seven variables that were looked at using chi-square analysis are the important ones. Some proof of this statement is found in the examination of the evaluation done on the variables.

Another problem associated with the type of analysis undertaken is the actual credit criterion that was employed. The quality of credit was assumed to be directly related to the present condition of the account balance. This may not actually be the case. A realization of these two problems leads to the drawing of some implications that would have to be considered if this type of analysis were to be attempted again.

Effects of Research Design on the Results of the Study

Treating the repayment experience first, some thought must be given to defining the quality of credit

in a truly representative manner. In this study, quality was a point in time inference. That is, if the present time period is period t_n and there are no payments overdue on the account, the repayment experience is expressed as $t_n = 0$. Herein lies the problem; the nature of repayment experience is not a statistic one, patterns of payment behaviour fluctuate over time,

$$t_1 = 0, \quad t_2 = 1, \quad t_3 = 0, \ \ldots, \ t_n = 0.$$

This simplified pattern indicates that the individual actually went into a delinquent position in time period two, recovered in time period three, and retains a non-delinquent position in time period n. This type of behaviour is not distinguished in the study from that of a user whose payment history is without delinquency.

What would have to be done is to incorporate a time and delinquency factor into the repayment experience. This factor would relate how long the account had been held, how often it had gone into delinquency, and to what degree. This type of distinction would allow for a more comprehensive quality of credit breakdown, and provide for a more realistic distinction to be made between good and poor credit risk.

The research design put further limitations upon the number of characteristics from the application form that could be used in the main body of the analysis. This limitation took the form of allowing only those character-

istics that were quantifiable to be used in both the regression and discriminant analyses. The chi-square analysis performed on non-quantifiable characteristics indicates that their exclusion from the evaluation may be one of the reasons why the two techniques failed to produce useable results.

To overcome this problem of excluded variables, either some form of quantifying device must be devised, or a different type of technique must be used which allows for qualitative data. It is erroneous to assume that valid conclusions can be drawn from examining only half of the available information.

Given that these refinements could be made, then the use of regression analysis and discriminant analysis would be justified. In light of the present condition of the data used the techniques are not operable and represent an exercise in futility since no meaningful level of significance can be attained by using them.

Marketing Implications

Up to this point an assumption has been made concerning the relationship of credit card user characteristics and repayment experience. This assumption forms the basis of the hypothesis in Chapter I; that there was a discernible relationship, and that it was quantifiable and predictable. If the objections to the type of analysis technique are removed, then a conclusion may be drawn with

respect to the original hypothesis. This conclusion relates to the fact that no quantifiable or predictable relationship does exist between card user characteristics and repayment experience. If this conclusion is correct then there are some significant marketing implications to be derived from this.

As has been noted, the extension of credit is a marketable service that business in the western societies uses as an inducement to procure a clientele. Those who market the service the most effectively are those who are able to produce benefits, both for the client and themselves. This optimum is not always reached, as is evidenced by the fact that delinquencies occur. The major resource of the firm for deciding who is a desirable client, is the credit card application form. If, as is being suggested here, there is no relationship, then there should be no application form. All that should be required of the potential user is name, address, and signature on a commitment to debt repayment. While this suggestion may seem unrealistic, it is consistent with the findings of the study.

There may be some secondary benefits that are associated with the abolition of the application form in the reduction of the disutility associated with forcing a potential user to complete the form. The process of requiring the application form to be completed may be some form of screening device used by the client, not the firm,

to assess whether or not credit is desirable with this particular establishment. The assumption being that those who are best able to get credit, that is, the best of the good credit risk group, will gravitate to those firms that entail the least complicated mechanism for procurement.

This observation, while somewhat nebulous, is meaningful. The services that organizations provide, auxilliary to the actual process of marketing commodities, is a basic feature that distinguishes firms in a homogenous market. The provision for credit on a minimal "invasion" of the potential user's personal history, becomes an advantageous device for attracting customers. In the company used as the basis for this study, approximately 50% of their business is done on a credit basis. Any mechanism that either increases the effectiveness of the screening of potential credit card users, or that entices additional good risk users on the basis of the service provided, would tend to have a marked effect on the overall profitability of the firm.

These observable values of credit analysis have increasingly important implications in the competitive market place, both from the point of view of the firm and the prospective credit card user.

Value of Credit Analysis

David Durand in his study of credit risks makes the following statement: "Owing to the fact that the analy-

sis of credit experience is expensive and that the practical value of the results appears to be limited, many lenders may conclude that analysis is not worthwhile.... They may point out, and rightly, that risk selection entails a margin of uncertainty that defies solution, and that regardless of research, no lender can ever expect to perfect his selection technique to point of no losses". (Durand, 1941, p. 99).

The acceptance of this point of view is inconsistent with the overall objective of any organization -- viability. The value of credit analysis is many-faceted in that it takes in the consumer as well as the firm. Elements of militant consumerism may force organizations into taking some steps to increase the efficiency of their selection techniques, not only for the purpose of increasing profitable sales, but also to meet the requirements of a new social responsibility that may be forced upon them. In this case the responsibility may fall upon the firm for those it allowed to become delinquent, that is, the responsibility of the firm is to better discriminate between who acquires credit and who does not, with the consequences being that debt is borne by the firm, not the individual.

The ability to be selective in risk-taking has become an absolute necessity. The flat statement that a lender can never expect to be selective to the point of no losses may be true, but successive approximations of this point can only be achieved by placing greater emphasis

on the use of sophisticated techniques. The techniques used in this study were themselves inadequate tools, but were restricted in their analysis. The inclusion of more characteristics, and indeed expanding the extent of analysis to include factors such as the general level of economic activity and other external indicators to the firm may provide greater predictive models in evaluating the potentialities of prospective credit users.

BIBLIOGRAPHY

Burger, Philip C., ed. A Handbook of Modern Multivariate Statistical Procedures, Working Draft, June, 1970.

Dixon, W. J., ed. Biomedical Computer Programs. Los Angeles: University of California Press, 1964.

Draper, N. R. and Smith, H. Applied Regression Analysis. New York: John Wiley and Sons, Inc., 1968, 2nd edition.

Durand, David. Risk Elements in Consumer Instalment Financing. Ann Arbour: University Microfilms, Inc., 1966.

Earley, J. S. "X Problems in the Measurement of the Quality of Credit". Proceedings of the Business and Economics Statistics Section, 1966.

Ferber, Robert. Market Research. New York: McGraw Hill Book Company, 1949.

Frank, Ronald and Green, Paul E. Quantitative Methods in Marketing. Englewood Cliffs, N.J.: Prentice Hall Inc., 1967.

Freund, J. E. and Williams, F. J. Modern Business Statistics. Englewood Cliffs, N.J.: Prentice Hall Inc., 1958.

Green, Paul and Tull, Donald. Research for Marketing Decisions. Englewood Cliffs, N.J.: Prentice Hall Inc., 1st Edition 1966, 2nd Edition 1970.

Grobben, G. Stepwise Multiple Regression. University of Alberta Department of Computing Science Program Library. March, 1970.

Hambly, W. J., ed. Credits and Collections in Canada. Toronto: The Ryerson Press, 1969.

Johnson, J. Econometric Methods. New York: McGraw Hill Book Co. Inc., 1963.

Massy, William. "Discriminant Analysis of Audience Characteristics." Journal of Advertising Research, V., No. 1, March, 1965, pp. 39 - 48.

Massy, William F., Frank, Ronald E. and Lodahl, Thomas. Purchasing Behavior and Personal Attributes. Philadelphia: University of Pennsylvania Press, 1968.

Moore, G. H. and Klein, P. A. The Quality of Consumer Instalment Credit. New York: Columbia University Press, 1967.

Nolan, Richard L., and Schneck, Rodney E. "Small Businessmen, Bank Managers, and Their Relative Susceptability to Right Wing Extremism." Canadian Journal of Political Science, II, No. 1, (March, 1969).

Rao, C. R. ed. Contributions to Statistics. Calcutta, India; Statistical Publishing Company, 1963.

Suits, D. B. "Use of Dummy Variables in Regression Equations," Journal of the American Statistical Association, Vol. 52, 1957, pp. 548 - 551.

Ziegel, J. S. and Olley, R. E. eds. Consumer Credit in Canada. Proceedings of a "Conference on Consumer Credit," Saskatoon: The University of Saskatchewan, 1966.

MR.
MRS.
MISS

FIRST | INITIAL | LAST | WIFE'S NAME

STREET ADDRESS

CITY | PROV. | ENTERED | K.P.N. | PLATE | CONTRACT

HOME PHONE NUMBER

INTERVIEWER	APPROVED BY	DATE	REFERRAL LIMIT	INITIALS
		/ /		
DATE / /	DATE	/ /		
		/ /		
		/ /		

[redacted] PURPOSE ACCOUNT

MARRIED ☐
SINGLE ☐
WIDOW/ER ☐
DEPENDANTS_____
FAMILY ALLOWANCE_____
OWN ☐
RENT ☐
BOARD ☐
AGE_____
HOW LONG AT PRESENT ADDRESS?_____

FORMER ADDRESS (IF LESS THAN 2 YRS. AT PRESENT ADDRESS)_____ HOW LONG?_____

EMPLOYER_____ ADDRESS_____ BUSINESS PHONE_____
(IF MARRIED GIVE HUSBAND'S EMPLOYER)

HOW LONG?_____ OCCUPATION_____ S. INS. #_____ TIME CARD OR BADGE No._____ EARNINGS $_____ MONTH ☐ WEEKLY ☐

FORMER EMPLOYER (IF LESS THAN 1 YEAR WITH PRESENT EMPLOYER)_____ ADDRESS_____ HOW LONG?_____

NAME AND ADDRESS OF BANK_____ BRANCH_____ TYPE CURRENT ☐ SAVINGS ☐ PERS. CHEQ. ☐ NUMBER_____ NUMBER_____

EXPLAIN OTHER INCOME IF ANY (INCLUDE WIFE'S EMPLOYMENT)

CURRENT CREDIT OBLIGATIONS

NAME & ADDRESS	ACCT. #	AMOUNT

PERSONAL OR CREDIT REFERENCES

RECORD OF PURCHASES			DATE	DIV.	AMOUNT
DATE	DIV	AMOUNT			

CREDIT HISTORY

SPECIAL NOTATIONS

ACCOUNT WITH [redacted]
☐ YES ☐ NO
☐ CHG. ☐ APA ☐ HLC
☐ OPEN ☐ CLOSED
ACCOUNT NUMBER

PREVIOUS [redacted] ACCOUNT
DATE_____ AMOUNT $_____
WHAT STORE_____
ACCOUNT NO._____
RATING (CR206)

AUTHORIZED PURCHASERS
1.
2.

IF PURCHASER IS A FARMER:
NAME AND ADDRESS OF OWNER

SIZE OF FARM_____ No. OF ACRES UNDER CULT._____

CUSTOMER'S SIGNATURE

5929 REV. 3/70

ADDRESS

MR. MRS. MISS
FIRST
INITIAL
LAST

DATE	REFERRAL LIMIT	INITIALS
/ /		
/ /		
/ /		

APPENDIX I

APPENDIX II

Description of the Use of Dummy Variables

The use of dummy variables in this study was for the purpose of representing non-quantifiable variables. The dummy variables used in this regression model were:

1. Marital status
2. Own-Rent-Board
3. Occupation
4. Sex
5. Presence of current liabilities
6. Presence of other income
7. Bank account held.

The use of dummy variables is discussed in Johnson, (Johnson, 1963, pp. 221-28) as it applies to regression analysis. Green and Tull (Green and Tull, 1970, p. 321) also make use of this dimension of quantifying non-scaler variables and provide an example of how its use may be applied to the BMD02R step-wise regression analysis computer programme.

Following the example format of Green and Tull the category of sex is discussed here:

Sex	Dummy Variable
Male	00
Female	01

By using this technique it is possible to describe males and females independently. According to Johnston this technique may also be applied to the dependent variable, if this is the case then some higher level of precision may be attainable by the use of a dummy variable to represent some qualitative level of credit. In this manner a finer distinction could be drawn with respect to risk in consumer credit evaluation.

Description of Occupational Groupings

Group	Description
1	Professional category
2	Clerical, includes secretaries, typists
3	Salesperson, Type I, behind sales counter
4	Salesperson, Type II, commercial representatives
5	Other clerical types, agents,messengers
6	Proprietors
7	Managers and officials
8	Skilled wage earners
9	Semi-skilled and unskilled earners
10	Service trades, including teachers
11	Miscellaneous

Description of Marital Status Groupings

1	Single
2	Married
3	Other

Description of Residence Groupings

1	Own
2	Rent
3	Board

The Following Variables are Dichotomous, Yes/No Alternative Groupings

1	Bank Account
2	Other Income
3	Other Liabilities

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
1	0.0	1.65876	-1.65876	0.141421E-01	1.17507	2.14245	-2.43725	5.75477
2	0.0	1.68855	-1.68855	0.199126E-01	1.11460	2.26251	-2.41910	5.79620
3	0.0	1.17314	-1.17314	0.446911E-01	0.313289	2.03299	-2.98411	5.33038
4	0.0	0.220292	-0.220292	0.134032E-01	-0.250594	0.691178	-3.87423	4.31481
5	0.0	1.09954	-1.09954	0.274754E-01	0.425343	1.77373	-3.02331	5.22239
6	0.0	1.22084	-1.22084	0.359277E-01	0.449688	1.99179	-2.91693	5.36061
7	0.0	1.77989	-1.77989	0.228660E-01	1.16484	2.39493	-2.33371	5.89348
8	0.0	1.26628	-1.26628	0.159662E-01	0.752340	1.78022	-2.83341	5.36598
9	0.0	0.745196	-0.745196	0.272137E-01	0.742112E-01	1.41616	-3.37714	4.86751
10	0.0	2.46826	-2.46826	0.141173E-01	1.99499	2.95152	-1.62771	6.56422
11	0.0	1.64519	-1.64519	0.314936E-01	0.923325	2.36706	-2.48572	5.77610
12	0.0	0.731618	-0.731618	0.140393E-01	0.249705	1.21353	-3.36418	4.82742
13	0.0	1.84176	-1.84176	0.281341E-01	1.15953	2.52398	-2.28241	5.96593
14	0.0	1.44088	-1.44088	0.871887E-01	0.239885	2.64188	-2.80008	5.68184
15	0.0	1.52423	-1.52423	0.261841E-01	0.866066	2.18238	-2.59604	5.64449
16	0.0	1.13170	-1.13170	0.311201E-01	0.414184	1.84922	-2.92845	5.26186
17	0.0	1.48847	-1.48847	0.236490E-01	0.862980	2.11395	-2.62670	5.60363
18	0.0	1.16070	-1.16070	0.139306E-01	0.647335	1.67406	-2.93693	5.26032
19	0.0	1.27281	-1.27281	0.222756E-01	0.665754	1.87986	-2.83960	5.38521
20	0.0	1.39346	-1.39346	0.184190E-01	0.841452	1.94547	-2.71118	5.49810
21	0.0	2.33980	-2.33980	0.159119E-01	1.82674	2.85287	-1.75978	6.43939
22	0.0	1.63061	-1.63061	0.627731E-01	0.511555	2.64967	-2.54246	5.82369
23	0.0	2.49484	-2.49484	0.739937E-01	1.34446	3.64521	-1.73207	6.72174
24	0.0	0.983208	-0.983208	0.143104E-01	0.496639	1.46978	-3.11315	5.07956
25	0.0	1.78596	-1.78596	0.169460E-01	1.25649	2.31544	-2.31571	5.88764
26	0.0	1.51727	-1.51727	0.151647E-01	1.01640	2.01815	-2.58080	5.61535
27	0.0	0.756813	-0.756813	0.360245E-01	-0.151764E-01	1.52880	-3.38315	4.89678
28	0.0	1.24388	-1.24388	0.333431E-01	0.501178	1.98658	-2.89073	5.37848
29	0.0	2.69334	-2.69334	0.445832E-01	1.79683	3.58985	-1.47164	6.85833
30	0.0	1.76222	-1.76222	0.306803E-01	1.04747	2.47696	-2.36746	5.89189
31	0.0	1.30391	-1.30391	0.106159E-01	0.884841	1.72299	-2.78497	5.39280
32	0.0	2.08192	-2.08192	0.194350E-01	1.51479	2.64884	-2.02487	6.18850
33	0.0	1.20993	-1.20993	0.213255E-01	0.615015	1.80464	-2.90079	5.32045
34	0.0	1.69246	-1.69246	0.231240E-01	1.07395	2.31096	-2.42166	5.80657
35	0.0	0.621915	-0.621915	0.179871E-01	0.763070E-01	1.16732	-3.48196	4.72558
36	0.0	2.22558	-2.22558	0.140277E-01	1.71066	2.74051	-1.87423	6.32540
37	0.0	1.23134	-1.23134	0.176828E-01	0.755678	1.70711	-2.86374	5.32642
38	0.0	0.922433	-0.922433	0.227791E-01	0.308558	1.53631	-3.19098	5.03585
39	0.0	2.37216	-2.37216	0.257481E-01	1.68253	3.06179	-1.75324	6.49756
40	0.0	0.936073	-0.936073	0.166999E-01	0.410457	1.46169	-3.16510	5.03725
41	0.0	0.589659	-0.589659	0.149023E-01	0.931354E-01	1.08618	-3.50789	4.68721
42	0.0	1.96890	-1.96890	0.226402E-01	1.35690	2.58090	-2.14424	6.08204
43	0.0	0.688572	-0.688572	0.256420E-01	0.372612E-01	1.33988	-3.43060	4.80774
44	0.0	1.07632	-1.07632	0.259261E-01	0.421414	1.73123	-3.04342	5.19606
45	0.0	0.945573	-0.945573	0.221535E-01	0.340118	1.55103	-3.16660	5.05774
46	0.0	1.91200	-1.91200	0.376418E-01	1.18462	2.65937	-2.22345	6.04745
47	0.0	0.230689	-0.230689	0.476421E-01	-0.657096	1.11847	-3.93243	4.39380
48	0.0	2.14792	-2.14792	0.507791E-01	1.23145	3.06437	-2.02141	6.31724
49	0.0	1.54398	-1.54398	0.625139E-01	0.532031	2.56593	-2.64358	5.74154
50	0.0	0.108002	-0.108002	0.413852E-01	-0.713435	0.935438	-4.04266	4.25866
51	0.0	2.83519	-2.83519	0.688084E-01	1.76927	3.90311	-1.36877	7.04115
52	0.0	1.66046	-1.66046	0.191429E-01	1.09771	2.22321	-2.44564	5.76656
53	0.0	2.21026	-2.21026	0.251752E-01	1.58491	2.85561	-1.90797	6.32849
54	0.0	1.01775	-1.01775	0.707291E-01	0.432147	1.60335	-3.09155	5.12704

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
55	0.0	2.23654	-2.23654	0.104983E-01	1.81193	2.66115	-1.85291	6.32600
56	0.0	2.03129	-2.03129	0.166693E-01	1.50615	2.55642	-2.06983	6.13240
57	0.0	0.272348	-0.272348	0.221362E-01	-0.332802	0.877499	-3.83977	4.38447
58	0.0	1.03753	-1.03753	0.287225E-01	0.348207	1.72686	-3.08782	5.16288
59	0.0	1.27033	-1.27033	0.217953E-01	0.669951	1.87081	-2.84111	5.38177
60	0.0	1.79506	-1.79506	0.844507E-01	0.613075	2.97705	-2.44055	6.03068
61	0.0	0.781680	-0.781680	0.261863E-01	0.123493	1.43987	-3.33858	4.90194
62	0.0	1.42491	-1.42491	0.202360E-01	0.846316	2.00351	-2.68339	5.53321
63	0.0	0.751391	-0.751391	0.173875E-01	0.215062	1.28772	-3.35117	4.85395
64	0.0	1.22995	-1.22995	0.142952E-01	0.743645	1.71625	-2.96637	5.32627
65	0.0	0.579441	-0.579441	0.213861E-01	-0.153681E-01	1.17425	-3.53117	4.69005
66	0.0	2.53799	-2.53799	0.816891E-01	1.37549	3.70050	-1.69223	6.76822
67	0.0	1.16145	-1.16145	0.190437E-01	0.600072	1.72283	-2.94446	5.26736
68	0.0	0.727699	-0.727699	0.142194E-01	0.242470	1.21251	-3.35868	4.82366
69	0.0	1.68695	-1.68695	0.222631E-01	1.07990	2.29380	-2.42554	5.79924
70	0.0	0.947562	-0.947562	0.241106E-01	0.263199	1.63193	-3.17696	5.07209
71	0.0	1.26359	-1.26359	0.242733E-01	0.439821	1.89736	-2.85284	5.38002
72	0.0	1.05652	-1.05652	0.149407E-01	0.559354	1.55368	-3.04111	5.15414
73	0.0	0.490261	-0.490261	0.190132E-01	-0.705530E-01	1.05118	-3.61559	4.59611
74	0.0	0.666605	-0.666605	0.152675E-01	0.164033	1.16918	-3.43168	4.76489
75	0.0	0.121699	-0.121699	0.426270E-01	-0.716960	0.961458	-4.03144	4.27484
76	0.0	0.643252	-0.643252	0.126070E-01	0.168799	1.11771	-3.45168	4.73818
77	0.0	1.25077	-1.25077	0.165856E-01	0.720664	1.78088	-2.85098	5.35252
78	0.0	1.01005	-1.01005	0.310975E-01	0.292791	1.72730	-3.12006	5.14016
79	0.0	0.894806	-0.894806	0.111603E-01	0.445127	1.32448	-3.19518	4.98479
80	0.0	0.902276	-0.902276	0.166915E-01	0.279790	1.32776	-3.29888	4.90343
81	0.0	0.204659	-0.204659	0.353515E-01	-0.560086	0.969404	-3.93396	4.34328
82	0.0	1.15872	-1.15872	0.246163E-01	0.520565	1.79687	-2.95839	5.27583
83	0.0	0.775074	-0.775074	0.120101E-01	0.329330	1.22092	-3.31663	4.86678
84	0.0	1.21720	-1.21720	0.113504	-0.153108	2.58751	-3.07478	5.50918
85	0.0	1.09861	-1.09861	0.155187E-01	0.591926	1.60530	-3.00018	5.19740
86	0.0	1.78250	-1.78250	0.179937E-01	1.23690	2.32809	-2.32129	5.88628
87	0.0	1.01475	-1.01475	0.571451E-01	0.424441E-01	1.98705	-3.16720	5.19670
88	0.0	0.796355	-0.796355	0.441664E-01	-0.584365E-01	1.65114	-3.35985	4.95256
89	0.0	1.57604	-1.57604	0.656431E-01	0.532363	2.61972	-2.62308	5.77516
90	0.0	2.18813	-2.18813	0.333937E-01	1.44487	2.93140	-1.94657	6.32284
91	0.0	1.54908	-1.54908	0.249256E-01	0.906935	2.19123	-2.56865	5.66691
92	0.0	0.948067	-0.948067	0.250947E-01	0.303744	1.59239	-3.17000	5.06614
93	0.0	1.33251	-1.33251	0.139676E-01	0.851808	1.81321	-2.76315	5.42817
94	0.0	-0.775132E-01	0.775132E-01	0.541874E-01	-0.829561	0.674535	-4.21381	4.05878
95	0.0	0.372699	-0.372699	0.212043E-01	-0.219565	0.964933	-3.73755	4.48295
96	0.0	0.228563E-01	-0.228563E-01	0.467093E-01	-0.874821	0.920534	-4.14238	4.18809
97	0.0	1.89300	-1.89300	0.337114E-01	1.14621	2.63980	-2.24234	6.02834
98	0.0	2.49062	-2.49062	0.423020E-01	1.65407	3.32718	-1.66187	6.64312
99	0.0	1.77581	-1.77581	0.620464E-01	0.762668	2.79895	-2.41583	5.96745
100	0.0	0.898963E-01	-0.898963E-01	0.484920E-01	-0.805772	0.985565	-4.07491	4.25470
101	0.0	0.741462	-0.741462	0.254145E-01	0.930469E-01	1.38988	-3.37725	4.96017
102	0.0	2.45766	-2.45766	0.200803E-01	1.88129	3.03402	-1.65043	6.56565
103	0.0	0.817482	-0.817482	0.307460E-01	0.104289	1.53067	-3.31192	4.94689
104	0.0	0.864060	-0.864060	0.389522E-01	0.610051E-01	1.66712	-3.28181	5.00993
105	0.0	0.459280E-01	-0.459280E-01	0.154441E-01	-0.478809	0.570665	-4.05514	4.14699
106	0.0	2.61438	-2.61438	0.367639E-01	1.83451	3.39425	-1.52707	6.75582
107	0.0	0.998805	-0.998805	0.399483E-01	0.185859	1.81175	-3.14809	5.14660
108	0.0	1.42089	-1.42089	0.167371E-01	0.894678	1.94708	-2.68047	5.52213

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109	0.0	0.921659	-0.921659	0.135259E-01	0.448623	1.39469	-3.17311	5.01643
110	0.0	1.32406	-1.32406	0.233265E-01	0.702848	1.94526	-2.79046	5.43858
111	0.0	0.992611	-0.992611	0.201230E-01	0.415634	1.56959	-3.11546	5.10068
112	0.0	1.56623	-1.56623	0.321179E-01	0.837202	2.29516	-2.56592	5.69839
113	0.0	1.21291	-1.21291	0.412726E-01	0.386599	2.03922	-2.93753	5.36335
114	0.0	1.09300	-1.09300	0.181396E-01	0.545188	1.64081	-3.01108	5.19707
115	0.0	0.240903	-0.240903	0.117696	-1.15448	1.63629	-4.05915	4.54096
116	0.0	1.73563	-1.73563	0.313965E-01	1.01493	2.45633	-2.39508	5.86634
117	0.0	1.19031	-1.19031	0.587373E-01	0.194553	2.16607	-3.00479	5.36542
118	0.0	1.52399	-1.52399	0.171877E-01	0.990750	2.05722	-2.57817	5.62615
119	0.0	1.66440	-1.66440	0.181272E-01	1.11678	2.21202	-2.43965	5.76845
120	0.0	2.22423	-2.22423	0.647373E-01	1.18935	3.25911	-1.97271	6.42117
121	0.0	2.04590	-2.04590	0.188344E-01	1.48770	2.60410	-2.05658	6.15138
122	0.0	1.09802	-1.09802	0.145585E-01	0.607258	1.58878	-2.99883	5.19487
123	0.0	3.09256	-3.09256	0.542617E-01	2.14510	4.04001	-1.09369	7.26880
124	0.0	1.25427	-1.25427	0.425602E-01	0.417141	2.09141	-2.89833	5.40688
125	0.0	0.263053	-0.263053	0.121491E-01	-0.185244	0.711351	-3.82893	4.35504
126	0.0	0.844860	-0.844860	0.125465E-01	0.389264	1.30046	-3.24793	4.93765
127	0.0	0.663182	-0.663182	0.176407E-01	0.122963	1.20340	-3.43989	4.76625
128	0.0	1.74950	-1.74950	0.644957E-01	0.716558	2.78245	-2.44696	5.94597
129	0.0	0.408910	-0.408910	0.115630E-01	-0.284588E-01	0.846279	-3.68189	4.49971
130	0.0	1.18638	-1.18638	0.196502E-01	0.616219	1.75654	-2.92074	5.29350
131	0.0	0.710477	-0.710477	0.163025E-01	0.191152	1.22990	-3.38990	4.81085
132	0.0	1.49349	-1.49349	0.304892E-01	0.783294	2.20368	-2.63540	5.62238
133	0.0	1.60533	-1.60534	0.244102E-01	0.969858	2.24081	-2.51136	5.72203
134	0.0	1.78538	-1.78538	0.237862E-01	1.09529	2.47546	-2.34010	5.91086
135	0.0	1.91163	-1.91163	0.156446E-01	1.40289	2.42037	-2.18742	6.01068
136	0.0	1.65504	-1.65504	0.306917E-01	0.940158	2.36992	-2.47406	5.78474
137	0.0	0.886330	-0.886330	0.162922E-01	0.367169	1.40549	-3.21402	4.98668
138	0.0	1.56761	-1.56761	0.159950E-01	1.04821	2.07701	-2.53714	5.66236
139	0.0	0.572980	-0.572980	0.179043E-01	0.287396E-01	1.11722	-3.53062	4.67658
140	0.0	1.70118	-1.70118	0.234071E-01	1.07890	2.32346	-2.41350	5.81587
141	0.0	2.24049	-2.24049	0.106364E-01	1.82097	2.66000	-1.84844	6.32942
142	0.0	0.266384	-0.266384	0.161067E-01	-0.249813	0.782582	-3.83359	4.36636
143	0.0	1.72731	-1.72731	0.150898E-01	1.22767	2.22694	-2.37062	5.82523
144	0.0	0.337096	-0.337096	0.471870E-01	-0.546438	1.22063	-3.82512	4.49931
145	0.0	0.668483	-0.668483	0.148978E-01	0.172036	1.16493	-3.42905	4.76602
146	0.0	0.538071	-0.538071	0.312919E-01	-0.181414	1.25756	-3.59243	4.66857
147	0.0	1.38978	-1.38978	0.576749E-01	0.412976	2.36658	-2.79323	5.57278
148	0.0	1.04178	-1.04178	0.446401E-01	0.182417	1.90114	-3.11537	5.19892
149	0.0	1.71855	-1.71855	0.258244E-01	1.06493	2.37218	-2.40098	5.83809
150	0.0	2.25302	-2.25302	0.425415E-01	1.41500	3.09284	-1.89905	6.46689
151	0.0	0.597435	-0.597435	0.184063E-01	0.456185E-01	1.14925	-3.50718	4.70205
152	0.0	0.899605	-0.899605	0.252829E-01	0.252871	1.54634	-3.21884	5.01805
153	0.0	0.231068	-0.231068	0.214984E-01	-0.365302	0.827437	-3.87978	4.34191
154	0.0	0.128184	-0.128184	0.203624E-01	-0.452214	0.708582	-3.98037	4.23674
155	0.0	1.94490	-1.94490	0.302595E-01	1.23972	2.65009	-2.18313	6.07293
156	0.0	0.601910	-0.601910	0.120552E-01	0.338959	1.26486	-3.29171	4.89553
157	0.0	0.870364	-0.870364	0.145409E-01	0.378216	1.36251	-3.22666	4.96739
158	0.0	1.02441	-1.02441	0.285195E-01	0.226132	1.82268	-3.12054	5.16936
159	0.0	1.50000	-1.50000	0.639191E-01	0.471686	2.52832	-2.69533	5.69533
160	0.0	0.489243	-0.489243	0.135977E-01	0.149525E-01	0.963534	-3.60567	4.58415
161	0.0	1.46850	-1.46850	0.137041E-01	0.992325	1.94466	-2.62663	5.56364
162	0.0	1.42180	-1.42180	0.349157E-01	0.662878	2.18073	-2.71574	5.55935

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
163	0.0	1.05387	-1.05387	0.139542E-01	0.573315	1.53442	-3.04178	5.14951
164	0.0	1.58880	-1.58880	0.165806E-01	1.06506	2.11253	-2.51214	5.69973
165	0.0	2.01284	-2.01284	0.294059E-01	1.31533	2.71035	-2.11389	6.13957
166	0.0	0.639047	-0.639047	0.151822E-01	0.138784	1.14111	-3.45816	4.73806
167	0.0	1.26652	-1.26652	0.130566E-01	0.801764	1.73128	-2.82730	5.36034
168	0.0	1.78384	-1.78384	0.284267E-01	1.09207	2.46960	-2.34092	5.90860
169	0.0	0.871110	-0.871110	0.751776E-01	0.225725	1.51649	-3.24713	4.98934
170	0.0	0.350888	-0.350888	0.170084E-01	-0.179561	0.881337	-3.75091	4.45268
171	0.0	2.34055	-2.34055	0.159221E-01	1.82876	2.85235	-1.75887	6.43998
172	0.0	0.232374	-0.232374	0.303745E-01	-0.476496	0.941245	-3.89629	4.36104
173	0.0	2.52421	-2.52421	0.169014E-01	1.99543	3.05299	-1.57737	6.62579
174	0.0	2.51534	-2.51534	0.146177E-01	2.02358	3.00710	-1.58163	6.61231
175	0.0	1.36463	-1.36463	0.187684E-01	0.807412	1.92185	-2.74072	5.46998
176	0.0	2.19321	-2.19321	0.132008E-01	1.72589	2.66053	-1.90090	6.28733
177	0.0	1.60722	-1.60722	0.143230E-01	1.12044	2.09399	-2.48916	5.70360
178	0.0	0.481856	-0.481856	0.106203	-0.843646	1.80736	-3.79603	4.75974
179	0.0	0.220236	-0.220236	0.639244E-01	-0.715271	1.17374	-3.94634	4.40481
180	0.0	0.796541	-0.796541	0.257893E-01	0.143362	1.44972	-3.32292	4.91601
181	0.0	0.800703	-0.800703	0.231227E-01	0.182215	1.41919	-3.31341	4.91481
182	0.0	0.985964	-0.985964	0.278147E-01	0.307597	1.66433	-3.13757	5.10950
183	0.0	1.67954	-1.67954	0.153983E-01	1.17482	2.18426	-2.41901	5.77809
184	0.0	0.860371	-0.860371	0.243742E-01	0.225366	1.49538	-3.25625	4.97700
185	0.0	0.872484	-0.872484	0.154304E-01	0.367240	1.37773	-3.22613	4.97110
186	0.0	0.723314	-0.723314	0.127183E-01	0.264617	1.18201	-3.36982	4.81645
187	0.0	1.20270	-1.20270	0.224703E-01	0.592998	1.81240	-2.91010	5.31550
188	0.0	1.46531	-1.46531	0.375652E-01	0.676984	2.25363	-2.67773	5.60835
189	0.0	0.853447	-0.853447	0.203355E-01	0.160378	1.54652	-3.27253	4.97942
190	0.0	1.65463	-1.65463	0.261549E-01	0.681249	2.22802	-2.68560	5.59486
191	0.0	0.377886	-0.377886	0.188898E-01	-0.181132	0.936904	-3.72770	4.48348
192	0.0	1.48134	-1.48134	0.463840E-01	0.605352	2.35732	-2.67928	5.64195
193	0.0	0.719434	-0.719434	0.244694E-01	-0.886240E-01	1.52749	-3.42741	4.86628
194	0.0	1.40306	-1.40306	0.167390E-01	0.876833	1.92929	-2.69819	5.50432
195	0.0	1.34696	-1.34696	0.199568E-01	0.772370	1.92155	-2.76078	5.45470
196	0.0	1.17572	-1.17572	0.154527E-01	0.669952	1.68150	-2.92295	5.27440
197	0.0	2.18990	-2.18990	0.229008E-01	1.58560	2.79219	-1.92295	6.30075
198	0.0	0.814927	-0.814927	0.453768E-01	-0.514365E-01	1.68129	-3.34367	4.97353
199	0.0	0.450137	-0.450137	0.232850E-01	-0.170518	1.07079	-3.66430	4.56457
200	0.0	0.969276	-0.969276	0.212037E-01	0.376938	1.56161	-3.14098	5.07953
201	0.0	1.18573	-1.18573	0.210339E-01	0.595843	1.77562	-2.92417	5.29564
202	0.0	1.32196	-1.32196	0.220858E-01	0.717497	1.92642	-2.79006	5.43398
203	0.0	0.476304	-0.476304	0.113007E-01	0.439246E-01	0.908683	-3.61396	4.56657
204	0.0	0.163907	-0.163907	0.292607E-01	-0.415141	0.742755	-3.94454	4.27215
205	0.0	1.84865	-1.84865	0.132314E-01	1.38080	2.31651	-2.24552	5.94283
206	0.0	1.96835	-1.96835	0.101632E-01	1.55830	2.37839	-2.11962	6.05631
207	0.0	1.89470	-1.89470	0.222014E-01	1.28866	2.50074	-2.21755	6.00695
208	0.0	1.81384	-1.81384	0.973253E-02	1.41258	2.21510	-2.27326	5.90094
209	0.0	0.460197	-0.460197	0.211142E-01	-0.130919	1.05121	-3.64987	4.57026
210	0.0	0.301637	-0.301637	0.230187E-01	-0.315459	0.918732	-3.81226	4.41553
211	0.0	0.828815	-0.828815	0.166674E-01	0.503711	1.35392	-3.27229	4.92992
212	0.0	1.44531	-1.44531	0.254952E-01	0.790796	2.09983	-2.67436	5.56499
213	0.0	0.797390	-0.797390	0.140848E-01	0.332131	1.26265	-3.29648	4.89127
214	0.0	1.25126	-1.25126	0.227409E-01	0.637901	1.86462	-2.86208	5.36460
215	0.0	1.48156	-1.48156	0.254529E-01	0.796476	2.16864	-2.64225	5.60737
216	0.0	2.17599	-2.17599	0.525053E-01	1.24400	3.10799	-1.99611	6.34876

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
217	0.0	0.597446	-0.597446	0.109371E-01	0.172079	1.02291	-3.49209	4.68698
218	0.0	1.71245	-1.71245	0.230151E-01	1.09541	2.32950	-2.40144	5.82634
219	0.0	1.90144	-1.90144	0.638505E-01	0.873677	2.92921	-2.29375	6.09664
220	0.0	0.828852	-0.828852	0.447295E-01	-0.313323E-01	1.68904	-3.32846	4.98617
221	0.0	0.633695	-0.633695	0.116507E-01	0.194671	1.07272	-3.45728	4.72467
222	0.0	0.942400	-0.942400	0.152493E-01	0.440120	1.44468	-3.15585	5.04065
223	0.0	1.92434	-1.92434	0.119742E-01	1.47926	2.36942	-2.16729	6.01597
224	0.0	1.17894	-1.17894	0.340134E-01	0.428807	1.92907	-2.95701	5.31489
225	0.0	1.64922	-1.64922	0.232429E-01	1.02913	2.26931	-2.46513	5.76357
226	0.0	1.53514	-1.53514	0.140448E-01	1.05309	2.01720	-2.56068	5.63096
227	0.0	1.57530	-1.57530	0.175461E-01	1.03653	2.11407	-2.52758	5.67818
228	0.0	1.56555	-1.56555	0.193063E-01	1.00039	2.13070	-2.54088	5.67198
229	0.0	1.74014	-1.74014	0.903543E-02	1.35351	2.12676	-2.34555	5.82582
230	0.0	1.75613	-1.75613	0.145823E-01	1.26497	2.24729	-2.34077	5.85303
231	0.0	0.269626	-0.269626	0.193361E-01	-0.295957	0.835209	-3.83686	4.37611
232	0.0	0.781137	-0.781137	0.153765E-01	0.276771	1.28550	-3.31737	4.87964
233	0.0	0.848718	-0.848718	0.345248E-01	0.103994	1.59344	-3.28625	4.98369
234	0.0	0.828436	-0.828436	0.343593E-01	0.745006E-01	1.58237	-3.30820	4.96507
235	0.0	1.27669	-1.27669	0.202151E-01	0.698393	1.85498	-2.83157	5.38495
236	0.0	1.39538	-1.39538	0.214564E-01	0.799589	1.99116	-2.71538	5.50613
237	0.0	0.841586	-0.841586	0.195697E-01	0.272305	1.41087	-3.26541	4.94858
238	0.0	2.01294	-2.01294	0.155127E-01	1.50635	2.51952	-2.08584	6.11172
239	0.0	0.785159	-0.785159	0.124489E-01	0.331347	1.23897	-3.30743	4.87775
240	0.0	0.961096	-0.961096	0.131172E-01	0.488211	1.43398	-3.13365	5.05584
241	0.0	0.535019	-0.535019	0.196173E-01	-0.195476E-01	1.08989	-3.57001	4.64005
242	0.0	1.42928	-1.42928	0.159661E-01	0.915345	1.94322	-2.67041	5.52898
243	0.0	1.33619	-1.33619	0.316373E-01	0.612733	2.05964	-2.79500	5.46738
244	0.0	2.44186	-2.44186	0.156933E-01	1.93232	2.95140	-1.65728	6.54100
245	0.0	1.44851	-1.44851	0.121717E-01	0.999783	1.89725	-2.64351	5.54054
246	0.0	0.406605	-0.406605	0.972698E-02	0.540429E-02	0.807805	-3.68049	4.49370
247	0.0	0.539011	-0.539011	0.157570E-01	0.284487E-01	1.04957	-3.56026	4.63828
248	0.0	0.720412	-0.720412	0.135013E-01	0.247806	1.19302	-3.37431	4.81513
249	0.0	1.07316	-1.07316	0.130744E-01	0.608080	1.53823	-3.02070	5.16701
250	0.0	0.925549	-0.925549	0.340553E-01	0.174949	1.67615	-3.21048	5.06158
251	0.0	1.84047	-1.84047	0.383191E-01	1.04428	2.63667	-2.30408	5.98502
252	0.0	0.620766	-0.620766	0.202511E-01	0.419564E-01	1.19958	-3.48756	4.72909
253	0.0	1.71922	-1.71922	0.180339E-01	1.17301	2.26542	-2.38465	5.82308
254	0.0	1.18709	-1.18709	0.278654E-01	0.508128	1.86606	-2.93654	5.31073
255	0.0	0.454162	-0.454162	0.191603E-01	-0.106844	1.01717	-3.65197	4.56030
256	0.0	1.94295	-1.94295	0.213982E-01	1.34787	2.53793	-2.16779	6.05349
257	0.0	1.64629	-1.64629	0.183265E-01	1.09567	2.19691	-2.45816	5.75075
258	0.0	0.823250	-0.823250	0.343877E-01	0.160292E-01	1.63047	-3.32343	4.96993
259	0.0	1.13375	-1.13375	0.191765E-01	0.579500	1.69699	-2.97242	5.23991
260	0.0	1.22982	-1.22982	0.250193E-01	0.586467	1.87317	-2.88810	5.34774
261	0.0	0.518368	-0.518368	0.447576E-01	-0.342121	1.37686	-3.63901	4.67575
262	0.0	1.87158	-1.87158	0.483391E-01	0.977326	2.76584	-2.29292	6.03608
263	0.0	1.44669	-1.44669	0.271829E-01	0.776097	2.11729	-2.67557	5.56895
264	0.0	0.328607	-0.328607	0.395111E-01	-0.479886	1.13710	-3.81832	4.47553
265	0.0	0.721497	-0.721497	0.133816E-01	0.250990	1.19200	-3.37298	4.81597
266	0.0	1.32275	-1.32275	0.289989E-01	0.630118	2.01538	-2.80315	5.44866
267	0.0	1.02622	-1.02622	0.161017E-01	0.510100	1.54233	-3.07375	5.12618
268	0.0	1.37433	-1.37433	0.136295E-01	0.899488	1.84918	-2.72064	5.46931
269	0.0	1.33955	-1.33955	0.256541E-01	0.688090	1.99102	-2.77964	5.45875
270	0.0	0.811194	-0.811194	0.195715E-01	0.242168	1.38020	-3.29578	4.91815

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
271	0.0	1.44466	-1.44466	0.312474E-01	0.725678	2.16365	-2.68575	5.57507
272	0.0	0.781207	-0.781207	0.438813E-01	-0.708171E-01	1.63323	-3.37443	4.93684
273	0.0	1.93073	-1.93073	0.179610E-01	1.38562	2.47585	-2.17299	6.03445
274	0.0	0.916155	-0.916155	0.108680E-01	0.492134	1.34018	-3.17324	5.00555
275	0.0	1.20078	-1.20078	0.334987E-01	0.456347	1.94522	-2.93413	5.33570
276	0.0	0.614517	-0.614517	0.125183E-01	0.159429	1.06960	-3.47822	4.70725
277	0.0	1.74526	-1.74526	0.307025E-01	1.03257	2.45794	-2.38406	5.87457
278	0.0	0.142643	-0.142643	0.529305E-01	-0.773119	1.07840	-4.03096	4.31625
279	0.0	2.95677	-2.95677	0.572909E-01	1.98323	3.93031	-1.22547	7.13901
280	0.0	1.55762	-1.55762	0.206368E-01	0.973326	2.14192	-2.55149	5.66673
281	0.0	1.21780	-1.21780	0.196379E-01	0.647817	1.78778	-2.88930	5.32489
282	0.0	0.365086	-0.365086	0.707709E-01	-0.716938	1.44711	-3.84373	4.57390
283	0.0	0.955083	-0.955083	0.168247E-01	0.427505	1.48266	-3.14634	5.05651
284	0.0	1.57099	-1.57099	0.373076E-01	0.785270	2.35651	-2.57164	5.71342
285	0.0	1.12362	-1.12362	0.145243E-01	0.633439	1.61381	-2.97316	5.22041
286	0.0	1.07968	-1.07968	0.330742E-01	0.339976	1.81938	-3.05439	5.21374
287	0.0	0.676506	-0.676506	0.144185E-01	0.187715	1.16530	-3.42011	4.77312
288	0.0	1.75655	-1.75655	0.559222E-01	0.794702	2.71839	-2.42299	5.93608
289	0.0	1.77576	-1.77576	0.247047E-01	1.13647	2.41506	-2.34152	5.89305
290	0.0	1.18496	-1.18496	0.229751E-01	0.568453	1.80147	-2.92885	5.29878
291	0.0	0.259163	-0.259163	0.147441E-01	-0.234716	0.753048	-3.83806	4.35639
292	0.0	2.08249	-2.08249	0.119187E-01	1.63844	2.52653	-2.00904	6.17401
293	0.0	1.97343	-1.97343	0.101207E-01	1.58425	2.36261	-2.11445	6.06131
294	0.0	0.719306	-0.719306	0.165370E-01	0.191537	1.24707	-3.38215	4.82076
295	0.0	1.34260	-1.34260	0.195015E-01	0.774593	1.91060	-2.76423	5.44942
296	0.0	1.74056	-1.74056	0.213166E-01	1.14672	2.33441	-2.36991	5.85104
297	0.0	1.76480	-1.76480	0.123835E-01	1.31209	2.21751	-2.32767	5.85728
298	0.0	0.878937	-0.878937	0.382901E-01	0.104108	1.65377	-3.26156	5.01943
299	0.0	0.615221	-0.615221	0.136517E-01	0.139989	1.09045	-3.47990	4.71024
300	1.00000	2.37568	-1.37568	0.600406E-01	1.37905	3.37231	-1.81200	6.56336
301	1.00000	0.916611	0.833895E-01	0.145387E-01	0.426183	1.40704	-3.18020	5.01342
302	1.00000	1.87849	-0.878478	0.130027E-01	1.41468	2.34228	-2.21523	5.97219
303	1.00000	1.87098	-0.870876	0.161506E-01	1.35398	2.38778	-2.22919	5.97094
304	1.00000	1.80110	-0.801103	0.181234E-01	1.25354	2.34866	-2.30294	5.90515
305	1.00000	2.17477	-1.17477	0.153137E-01	1.67144	2.67810	-1.92361	6.27315
306	1.00000	1.21910	-0.219095	0.176745E-01	0.578359	1.75983	-2.88404	5.32223
307	1.00000	0.873851	0.126149	0.423677E-01	0.366502E-01	1.71105	-3.27877	5.02647
308	1.00000	2.14723	-1.14723	0.390307E-01	1.34368	2.95079	-1.99874	6.29320
309	1.00000	1.76354	-0.763536	0.359930E-01	0.991685	2.53519	-2.37637	5.90344
310	1.00000	1.95286	-0.952862	0.157345E-01	1.44266	2.46306	-2.14636	6.05209
311	1.00000	1.10353	-0.103534	0.153282E-01	0.583799	1.62327	-2.99689	5.20396
312	1.00000	1.24967	-0.249668	0.188633E-01	0.691037	1.80830	-2.85587	5.35520
313	1.00000	1.39981	-0.399809	0.131954E-01	0.932588	1.86703	-2.69429	5.49391
314	1.00000	1.82626	-0.826258	0.291815E-01	1.13145	2.52107	-2.30002	5.95253
315	1.00000	2.58453	-1.58453	0.535695E-01	1.63974	3.52932	-1.59111	6.76017
316	1.00000	1.30356	-0.303563	0.313427E-01	0.583484	2.02364	-2.82704	5.43417
317	1.00000	1.54127	-0.541266	0.319642E-01	0.814083	2.26845	-2.59058	5.67311
318	1.00000	1.65049	-0.650489	0.178601E-01	1.10692	2.19406	-2.45303	5.75400
319	1.00000	2.22280	-1.22280	0.123393E-01	1.77098	2.67461	-1.86958	6.31517
320	1.00000	1.89500	-0.895002	0.178547E-01	1.35152	2.43849	-2.20850	5.99851
321	1.00000	2.37426	-1.37426	0.842272E-01	1.19383	3.55468	-1.86092	6.60944
322	1.00000	1.31367	-0.313669	0.175252E-01	0.775222	1.85212	-2.78917	5.41651
323	1.00000	1.94288	-0.942880	0.239905E-01	1.32616	2.55960	-2.17097	6.05672
324	1.00000	1.12717	-0.127171	0.245944E-01	0.658007	1.76633	-2.99010	5.24444

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
325	1.00000	2.05059	-1.05059	0.319692E-01	1.32335	2.77783	-2.08127	6.18245
326	1.00000	2.30879	-1.30879	0.283774E-01	1.62352	2.99396	-1.81587	6.43345
327	1.00000	0.819260	0.181740	0.341199E-01	0.669561E-01	1.56956	-3.31790	4.95442
328	1.00000	0.717205	0.282795	0.118783E-01	0.273914	1.16050	-3.37424	4.80865
329	1.00000	1.20374	-0.203744	0.936127E-02	0.900213	1.68727	-2.79260	5.38009
330	1.00000	1.36996	-0.369959	0.217013E-01	0.770781	1.96913	-2.74129	5.48121
331	1.00000	0.588876	0.411124	0.134038	-0.900231	2.07798	-3.74250	4.92025
332	1.00000	1.06729	-0.662870E-01	0.289386E-01	0.374375	1.75820	-3.05950	5.19207
333	2.00000	1.55426	0.445738	0.106451E-01	1.13461	1.97391	-2.53468	5.64321
334	2.00000	2.10603	-0.106030	0.618654E-01	1.09437	3.11769	-2.08525	6.29731
335	2.00000	1.48620	0.513803	0.441069E-01	0.456370	2.51602	-2.70950	5.68190
336	2.00000	0.692198	1.30780	0.427836E-01	-0.149105	1.53350	-3.46126	4.84565
337	2.00000	0.967129	1.03287	0.118345E-01	0.524657	1.40960	-3.12422	5.05848
338	2.00000	0.618779	1.38122	0.149453E-01	0.121541	1.11602	-3.47585	4.71641
339	2.00000	2.01487	-0.148668E-01	0.448457E-01	1.15353	2.87620	-2.14269	6.17242
340	2.00000	1.88882	0.111182	0.295257E-01	1.18992	2.58771	-2.23814	6.01578
341	2.00000	1.87660	0.123403	0.409346E-01	1.05368	2.69952	-2.27317	6.02637
342	2.00000	0.793943	1.20606	0.342078E-01	0.416709E-01	1.54621	-3.34239	4.93028
343	2.00000	1.80065	0.199352	0.324565E-01	1.06769	2.53341	-2.33218	5.93348
344	2.00000	1.30425	0.695746	0.193852E-01	0.757953	1.87055	-2.80233	5.41084
345	2.00000	2.63753	-0.637531	0.540722E-01	1.69173	3.58334	-1.53834	6.81340
346	2.00000	2.49636	-0.496359	0.854159E-01	1.30763	3.68508	-1.74115	6.73386
347	2.00000	0.872302	1.12770	0.193456E-01	0.321351	1.42325	-3.23219	4.97680
348	2.00000	1.17733	0.822673	0.164584E-01	0.655526	1.69913	-2.92336	5.27801
349	2.00000	2.04762	-0.476179E-01	0.106610E-01	1.62765	2.46758	-2.04136	6.13659
350	2.00000	0.716421	1.28358	0.284930E-01	0.298569E-01	1.40299	-3.40847	4.84131
351	2.00000	1.19005	0.809947	0.131853E-01	0.732009	1.66610	-2.89503	5.29313
352	2.00000	1.20005	0.799948	0.166111E-01	0.675835	1.72427	-2.90095	5.30105
353	2.00000	1.36599	0.634008	0.665165E-01	0.316989	2.41499	-2.83446	5.56644
354	2.00000	0.329056	1.67094	0.327344E-01	-0.406837	1.06495	-3.80433	4.46244
355	2.00000	1.07578	0.924222	0.490415E-01	0.175050	1.97651	-3.09011	5.24167
356	2.00000	2.10403	-0.104026	0.113385E-01	1.67092	2.53713	-1.98632	6.19437
357	2.00000	1.73936	0.260644	0.389548E-01	0.958522	2.52019	-2.40227	5.88098
358	2.00000	2.10510	-0.105096	0.272832E-01	1.43329	2.77691	-2.01737	6.22756
359	2.00000	1.34389	0.656111	0.166839E-01	0.818525	1.86925	-2.75725	5.44503
360	2.00000	2.28518	-0.285176	0.151475E-01	1.78458	2.78577	-1.81287	6.38322
361	2.00000	1.57338	0.426623	0.160166E-01	1.05863	2.08813	-2.52642	5.67317
362	2.00000	1.69527	0.304731	0.382015E-01	0.900293	2.49024	-2.44905	5.83958
363	2.00000	1.53737	0.462636	0.234134E-01	0.914944	2.15980	-2.57733	5.65208
364	2.00000	1.98057	0.194330E-01	0.251412E-01	1.33565	2.62549	-2.13760	6.09873
365	2.00000	1.89925	0.100754	0.108887E-01	1.47482	2.32367	-2.19019	5.99868
366	2.00000	1.15040	0.849596	0.235196E-01	0.529248	1.77152	-2.96410	5.26491
367	2.00000	2.13060	-0.130601	0.116417E-01	1.69175	2.56946	-1.96036	6.22156
368	2.00000	1.24877	0.751226	0.139005E-01	0.769231	1.72832	-2.84675	5.34430
369	2.00000	1.99882	0.118256E-02	0.142672E-01	1.51799	2.48464	-2.09745	6.09508
370	2.00000	1.71022	0.289771	0.225032E-01	1.10945	2.33001	-2.39373	5.83218
371	2.00000	1.13519	0.864806	0.145195E-01	0.645090	1.62530	-2.96156	5.23197
372	2.00000	2.26708	-0.267077	0.194717E-01	1.69951	2.83464	-1.83968	6.37384
373	2.00000	1.74016	0.259845	0.226892E-01	1.12749	2.35282	-2.37308	5.85339
374	2.00000	2.07938	-0.793800E-01	0.318795E-01	1.35316	2.80560	-2.05230	6.21106
375	2.00000	0.261807	1.73819	0.520426E-01	-0.666073	1.18969	-3.91004	4.43365
376	2.00000	2.21036	-0.210357	0.318223E-01	1.48479	2.93592	-1.92121	6.34192
377	2.00000	1.05533	0.943668	0.700613E-01	-0.263891E-01	2.13905	-3.15266	5.26533
378	2.00000	0.210754	1.78925	0.234938E-01	-0.412678	0.834186	-3.90410	4.32561

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
379	2.00000	0.982865	1.01713	0.166004E-01	0.458811	1.50692	-3.11811	5.08384
380	2.00000	2.65546	-0.655456	0.249447E-01	2.01306	3.29785	-1.46231	6.77323
381	2.00000	1.45678	0.543221	0.192586E-01	0.907183	2.00638	-2.64754	5.56110
382	2.00000	1.39620	0.603795	0.213964E-01	0.901252	1.99116	-2.71443	5.50684
383	2.00000	1.70443	0.295568	0.184559E-01	1.15197	2.25689	-2.40028	5.80914
384	2.00000	1.06317	0.936830	0.171615E-01	0.530339	1.59600	-3.03894	5.16528
385	2.00000	0.542773	1.45723	0.201702E-01	-0.348806E-01	1.12043	-3.56540	4.65094
386	2.00000	1.24286	0.757143	0.429193E-01	0.400225	2.08549	-2.91086	5.39658
387	2.00000	0.715861	1.28414	0.173753E-01	0.179721	1.25200	-3.38668	4.81840
388	2.00000	0.778142	1.21586	0.369760E-01	0.202411E-02	1.56626	-3.35773	4.92601
389	2.00000	1.69229	0.307714	0.326352E-01	0.957510	2.42705	-2.44090	5.82548
390	2.00000	1.58462	0.415380	0.269072E-01	0.917434	2.25181	-2.53709	5.70633
391	2.00000	2.51012	-0.510121	0.203173E-01	1.93036	3.08988	-1.59834	6.61859
392	2.00000	0.178001E-02	1.99822	0.391203E-01	-0.302696	0.306256	-4.14437	4.14793
393	2.00000	1.33472	0.665276	0.936726E-02	0.941067	1.72838	-2.75153	5.42108
394	2.00000	1.84800	0.151996	0.304550E-01	1.13820	2.55781	-2.28082	5.97683
395	2.00000	2.09259	-0.925941E-01	0.399856E-01	1.27927	2.90592	-2.05528	6.24047
396	2.00000	0.747210	1.25279	0.152613E-01	0.244741	1.24968	-3.35106	4.84548
397	2.00000	2.10408	-0.104084	0.136559E-01	1.62878	2.57939	-1.99095	6.19911
398	2.00000	1.75841	0.241586	0.190995E-01	1.21121	2.30561	-2.34558	5.86241
399	2.00000	0.670334	1.32966	0.400033E-01	-0.143127	1.48389	-3.47752	4.81829
400	2.00000	1.69804	0.301964	0.629160E-01	0.677819	2.71825	-2.49531	5.89139
401	2.00000	2.25830	-0.258297	0.141012E-01	1.77530	2.74129	-1.83764	6.35423
402	3.00000	2.08934	0.910657	0.168714E-01	1.53059	2.64810	-2.01621	6.19489
403	3.00000	1.39831	1.60169	0.280280E-01	0.717369	2.07925	-2.72565	5.52226
404	3.00000	0.485077	2.51492	0.179789E-01	-0.541947E-01	1.02435	-3.61787	4.58802
405	3.00000	2.56607	0.433931	0.674341E-01	1.50986	3.62228	-1.63618	6.76832
406	3.00000	2.23063	0.769368	0.112270E-01	1.79966	2.66160	-1.85949	6.32075
407	3.00000	1.31037	1.68963	0.105903E-01	1.40181	2.32694	-2.17846	5.99921
408	3.00000	1.23338	1.76662	0.124869E-01	0.778875	1.68789	-2.85929	5.32605
409	3.00000	1.76869	1.23131	0.139423E-01	1.28842	2.24896	-2.32692	5.86430
410	3.00000	1.84717	1.15283	0.573747E-01	0.972920	2.92143	-2.33523	6.02958
411	3.00000	0.794869	2.20513	0.625529E-01	-0.222401	1.81214	-3.39777	4.98751
412	3.00000	1.71412	1.28588	0.226306E-01	1.10212	2.32611	-2.39902	5.82725
413	3.00000	1.94727	1.05273	0.176123E-01	1.40748	2.48705	-2.15575	6.05028
414	3.00000	1.77609	1.22391	0.131666E-01	1.30937	2.24280	-2.31796	5.87013
415	3.00000	2.43221	0.567793	0.147480E-01	1.90563	2.95858	-1.66907	6.53348
416	3.00000	2.22488	0.775123	0.159085E-01	1.71187	2.73789	-1.87470	6.32446
417	3.00000	2.43600	0.564002	0.500469E-01	1.52608	3.34591	-1.73189	6.60389
418	3.00000	2.53009	0.469905	0.237369E-01	1.90345	3.15674	-1.58525	6.64544
419	3.00000	1.03735	1.96265	0.142643E-01	0.551569	1.52312	-3.05892	5.13361
420	3.00000	1.34396	1.65604	0.511576E-01	0.424002	2.26391	-2.82614	5.51405
421	3.00000	2.35102	0.648976	0.221127E-01	1.74619	2.95585	-1.76105	6.46310
422	3.00000	0.751613	2.24839	0.340350E-01	0.124317E-02	1.50198	-3.38438	4.88760
423	3.00000	2.00618	0.993817	0.121536E-01	1.55778	2.45458	-2.08581	6.09818
424	3.00000	0.789229	2.21077	0.133364E-01	0.238461	1.34000	-3.31524	4.89370
425	3.00000	2.15665	0.843552	0.926705E-02	1.76490	2.54799	-1.92971	6.24261
426	3.00000	2.27105	0.728951	0.142581E-01	1.76539	2.76572	-1.82520	6.36729
427	3.00000	1.03890	1.96110	0.178503E-01	0.495472	1.58232	-3.06460	5.14235
428	3.00000	1.93335	1.06665	0.120415E-01	1.48702	2.37968	-2.15842	6.02512
429	3.00000	2.10319	0.896807	0.108007E-01	1.77049	2.61590	-1.89607	6.28245
430	3.00000	1.19245	1.80755	0.189482E-01	0.632567	1.75233	-2.91326	5.29815
431	3.00000	1.82153	1.17847	0.145188E-01	1.33144	2.31162	-2.27524	5.91831
432	3.00000	1.04418	1.95582	0.490892E-01	0.350446	1.74271	-3.08491	5.17227

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
433	3.00000	1.11508	1.88492	0.177842E-01	0.572666	1.65749	-2.98828	5.21844
434	3.00000	2.38478	0.615225	0.156919E-01	1.87527	2.89428	-1.71436	6.48391
435	3.00000	1.24911	1.75189	0.203417E-01	0.668005	1.82821	-2.86040	5.35662
436	3.00000	1.55669	1.44331	0.143756E-01	1.06902	2.04436	-2.53979	5.65317
437	3.00000	2.38135	0.618648	0.188714E-01	1.82261	2.94010	-1.72420	6.48690
438	4.00000	1.54904	2.45096	0.165005E-01	1.02657	2.07151	-2.55173	5.64981
439	4.00000	1.15161	2.84839	0.159561E-01	0.637832	1.66539	-2.94807	5.25128
440	4.00000	1.43905	2.56095	0.110464E-01	1.01157	1.86654	-2.65070	5.52881
441	4.00000	1.95897	2.04103	0.312512E-01	1.23595	2.67800	-2.17145	6.03939
442	4.00000	0.553085	3.44691	0.119632E-01	0.109213	0.997958	-3.53853	4.64470
443	4.00000	2.28367	1.71633	0.263940E-01	1.62287	2.94446	-1.83701	6.40434
444	4.00000	2.59863	1.40137	0.155633E-01	2.09122	3.10605	-1.50025	6.69752
445	4.00000	1.77460	2.22540	0.129229E-01	1.31402	2.23518	-2.31874	5.86795
446	4.00000	2.20776	1.79224	0.258405E-01	1.55393	2.86158	-1.91181	6.32733
447	4.00000	0.768610	3.23139	0.381177E-01	-0.254909E-01	1.56271	-3.37554	4.91276
448	4.00000	1.16040	2.83960	0.317872E-01	0.435236	1.88557	-2.97109	5.29190
449	4.00000	2.10421	1.90579	0.133371E-01	1.72449	2.66394	-1.90018	6.28860
450	4.00000	1.44475	2.55525	0.643325E-01	0.263598	2.62591	-2.79064	5.68014
451	4.00000	1.48040	2.51960	0.114294E-01	1.04557	1.91524	-2.61013	5.57093
452	4.00000	0.777994	3.22201	0.139802E-01	0.297079	1.25891	-3.31769	4.87368
453	4.00000	2.14818	1.85182	0.194331E-01	1.58118	2.71518	-1.95851	6.25486
454	4.00000	1.72460	2.27540	0.176506E-01	1.18423	2.26497	-2.37649	5.82769
455	4.00000	0.658798	3.34120	0.144732E-01	0.166477	1.14812	-3.43788	4.75548
456	4.00000	1.79118	2.20882	0.227574E-01	1.17760	2.40477	-2.32219	5.90455
457	4.00000	1.68431	2.31569	0.139561E-01	1.12427	2.24436	-2.42142	5.79004
458	4.00000	1.20699	2.79301	0.165035E-01	0.684469	1.72950	-2.89380	5.30777
459	4.00000	2.45223	1.54777	0.138807E-01	1.97303	2.93143	-1.64325	6.54772
460	4.00000	1.95890	2.04110	0.106664E-01	1.53883	2.37897	-2.13009	6.04789
461	4.00000	0.281535	3.71846	0.872943E-01	-0.920189	1.48326	-3.95963	4.52270
462	4.00000	1.59623	2.40377	0.265737E-01	0.933120	2.25935	-2.52482	5.71729
463	4.00000	0.887616	3.11238	0.243120E-01	0.253422	1.52181	-3.22888	5.00411
464	4.00000	1.60360	2.39640	0.313676E-01	0.883233	2.32396	-2.52705	5.73425
465	4.00000	0.753763	3.24624	0.195799E-01	0.184625	1.32290	-3.35322	4.86074
466	4.00000	0.777664	3.22233	0.153113E-01	0.274375	1.28095	-3.32071	4.87604
467	5.00000	2.67744	2.32256	0.320509E-01	1.94917	3.40571	-1.45459	6.80948
468	5.00000	1.78405	3.21595	0.538375E-01	0.840308	2.72780	-2.39135	5.95946
469	5.00000	1.98746	3.01254	0.268717E-01	1.32071	2.65420	-2.13418	6.10910
470	5.00000	1.20732	3.79268	0.461878E-01	0.333190	2.08145	-2.95291	5.36754
471	5.00000	1.89973	3.10027	0.102070E-01	1.48881	2.31066	-2.18832	5.98779
472	5.00000	2.80120	2.19880	0.688759E-01	1.73376	3.86864	-1.40389	7.00629
473	5.00000	1.80089	3.19911	0.220845E-01	1.13645	2.40533	-2.31113	5.91291
474	5.00000	1.98468	3.01532	0.127840E-01	1.52479	2.44456	-2.10859	6.07794
475	5.00000	0.845332	4.15467	0.144714E-01	0.356039	1.33463	-3.25134	4.94201
476	5.00000	1.27179	3.72821	0.127760	-0.182029	2.72561	-3.04758	5.59116
477	5.00000	1.46654	3.53346	0.223391E-01	0.856620	2.07445	-2.64600	5.57907
478	5.00000	1.58854	3.41146	0.682291E-01	0.526118	2.65096	-2.61528	5.79236
479	5.00000	1.30070	3.69930	0.210459E-01	0.710644	1.89076	-2.80923	5.41063
480	5.00000	2.07223	2.92777	0.262367E-01	1.41341	2.73105	-2.04813	6.19260
481	6.00000	1.83072	4.16928	0.291805E-01	1.13592	2.52552	-2.29555	5.95699
482	6.00000	2.30609	3.69391	0.436841E-01	1.45598	3.15619	-1.84916	6.46133
483	6.00000	2.08419	3.91581	0.393511E-01	1.27734	2.89103	-2.06242	6.23079
484	6.00000	2.77006	3.22994	0.553628E-01	1.61304	3.72708	-1.40837	6.94849
485	6.00000	2.18395	3.81605	0.143866E-01	1.70220	2.67770	-1.90654	6.28644
486	6.00000	1.83275	4.16725	0.202930E-01	1.25391	2.41159	-2.27558	5.94108

TABLE OF RESIDUALS AND 95% CONFIDENCE INTERVAL DF = 501 STUDENT-T = 1.960

CASE NO.	OBSERVED Y-VALUE	ESTIMATED Y-VALUE	RESIDUAL	XCX	CONFIDENCE LIMITS FOR THE PREDICTED MEAN-VALUE LOWER	UPPER	CONFIDENCE LIMITS FOR PRED. INDIVIDUAL OBSERVATIONS LOWER	UPPER
487	6.00000	1.73759	4.26241	0.174577E-01	1.20018	2.27500	-2.36511	5.84029
488	6.00000	2.41938	3.58062	0.402377E-01	1.60350	3.23527	-1.72899	6.56776
489	6.00000	1.95060	4.04940	0.160269E-01	1.42569	2.46552	-2.14921	6.05042
490	6.00000	2.44165	3.55835	0.686131E-01	1.37624	3.50706	-1.76293	6.64622
491	6.00000	1.62593	4.37407	0.311063E-01	0.908569	2.34330	-2.50420	5.75606
492	6.00000	1.99713	4.00287	0.120410E-01	1.55081	2.44345	-2.09463	6.08890
493	6.00000	2.25956	3.74044	0.335101E-01	1.51500	3.00412	-1.87537	6.39450
494	6.00000	1.40392	4.59608	0.955450E-02	1.00551	1.80232	-2.66290	5.49074
495	7.00000	2.23902	4.76098	0.564605E-01	1.27256	3.20548	-1.94158	6.41962
496	7.00000	2.02911	4.97189	0.167105E-01	1.50232	2.55389	-2.07309	6.12930
497	7.00000	1.90854	5.09146	0.300725E-01	1.20320	2.61387	-2.21952	6.03659
498	7.00000	2.28136	4.71864	0.446474E-01	1.42192	3.14079	-1.87580	6.43852
499	7.00000	2.03525	4.96475	0.105662E-01	1.61716	2.45335	-2.05353	6.12404
500	7.00000	1.64905	5.35095	0.164543E-01	1.12731	2.17079	-2.45163	5.74973
501	7.00000	2.11654	4.88346	0.427815E-01	1.27526	2.95782	-2.03691	6.26998
502	8.00000	1.21920	6.78080	0.190768E-01	0.657375	1.78102	-2.98677	5.32517
503	8.00000	0.995775	7.01422	0.799630E-01	-0.164423	2.13597	-3.24108	5.21263
504	8.00000	2.08706	5.91294	0.877739E-02	1.70599	2.46814	-1.99810	6.17223
505	9.00000	1.37736	7.62264	0.164391E-01	0.855863	1.89886	-2.72329	5.47801
506	9.00000	2.05548	6.94452	0.140475E-01	1.57341	2.53755	-2.04034	6.15130
507	9.00000	2.32801	6.67199	0.124350E-01	1.87445	2.78157	-1.76455	6.42058
508	9.00000	1.72571	7.27429	0.127865E-01	1.26575	2.18568	-2.36757	5.81899
509	9.00000	0.353474	8.64653	0.217561E-01	-0.246459	0.953407	-3.75798	4.45483
510	9.00000	1.85220	7.14780	0.119973E-01	1.40669	2.29771	-2.23948	5.94388
511	9.00000	2.15827	6.84173	0.960720E-02	1.76960	2.55694	-1.92857	6.24511
512	9.00000	1.86636	7.13364	0.194816E-01	1.29865	2.43407	-2.24042	5.97314
513	9.00000	1.44455	7.55545	0.203464E-01	0.864276	2.02472	-2.66398	5.55307
514	9.00000	2.52852	6.47148	0.644685E-01	1.49579	3.56125	-1.66789	6.72494
515	9.00000	1.59273	7.40727	0.234197E-01	0.970279	2.21517	-2.52198	5.70743

STOP 0
EXECUTION TERMINATED

APPENDIX IV

TABLE IX

CROSS CLASSIFICATION OF OCCUPATION TYPE

BY RISK GROUP

Occupation*	Good	Poor	Total
1	11	3	14
2	23	15	38
3	9	4	13
4	7	19	26
5	2	4	6
6	26	9	35
7	17	8	25
8	94	49	143
9	66	69	135
10	23	26	49
11	21	10	31
Total	299	216	515

X^2 test significant at .0005 level

*See Appendix II for description of Occupational Groupings

TABLE X

CROSS CLASSIFICATION OF SEX
BY RISK GROUP

Sex	Risk Group		
	Good	Poor	Total
Male	271	186	457
Female	28	30	58
Total	299	216	

X^2 test significant at 0.10 level

TABLE XI

CROSS CLASSIFICATION OF RESIDENCE
ARRANGEMENT BY RISK GROUP

Residence	Risk Group		
	Good	Poor	Total
Own	141	54	195
Rent	127	144	271
Board	31	18	49
Total	299	216	

X^2 test significant at .005 level

TABLE XII

CROSS CLASSIFICATION OF MARITAL STATUS
BY RISK GROUP

Marital State	Risk Group Good	Poor	Total
Married	238	173	411
Single	56	32	88
Other	5	11	16
Total	299	216	515

X^2 test significant at .010 level

TABLE XIII

CROSS CLASSIFICATION OF BANK ACCOUNTS
BY RISK GROUP

Bank Account	Risk Group Good	Poor	Total
Yes	291	203	494
No	8	13	21
Total	299	216	515

X^2 test significant at .100 level

TABLE XIV

CROSS CLASSIFICATION OF OTHER INCOME
BY RISK GROUP

Other Income	Risk Group Good	Poor	Total
Yes	81	72	153
No	218	144	362
Total	299	216	515

X^2 test significant at .200 level

TABLE XV

CROSS CLASSIFICATION OF OTHER
LIABILITIES BY RISK GROUP

Other Liabilities	Risk Group Good	Poor	Total
Yes	268	195	463
No	31	21	52
Total	299	216	515

X^2 test significant at .800 level